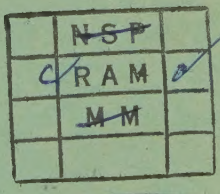
AN FORAS TALUNTAIS

PLANT SCIENCES AND CROP HUSBANDRY DIVISION



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An Foras Taluntais
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PLANT SCIENCES AND CROP HUSBANDRY DIVISION

RESEARCH REPORT 1961

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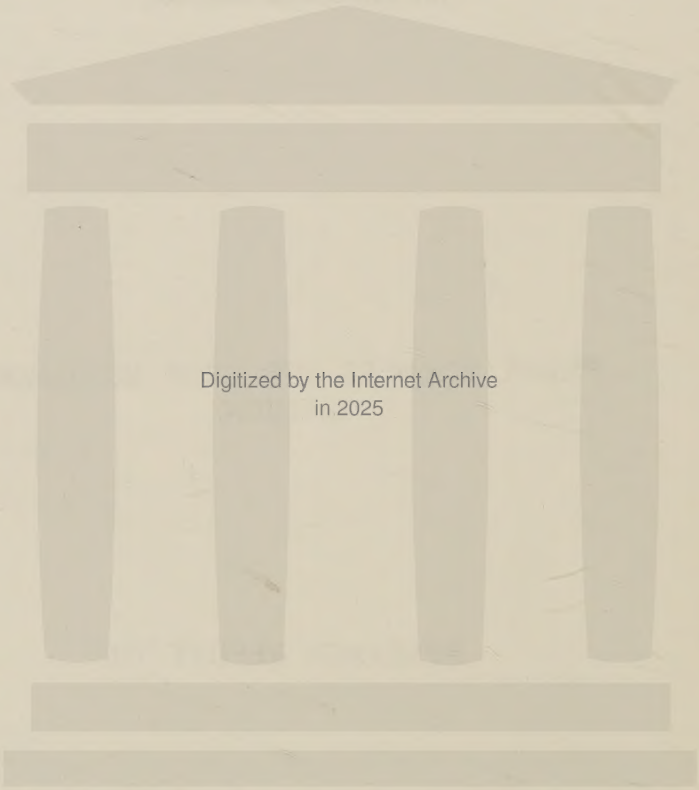

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To the Chairman and Council of An Foras Taluntais

I have the honour to present this second series of Research Reports (one for each of the five Divisions) covering the research programme of An Foras Taluntais.

It is possible to report considerable progress in the year under review and in evaluating this progress the two series of reports should be taken together. I know you will understand that, as many of the experiments are of a long term nature and that year to year climatic variations must also be taken into account, conclusive results are not yet available for many facets of the work in progress. However, we feel that the data already available and summarised in these reports may be of value to persons engaged in providing advisory services in relation to agriculture and to research workers interested in the several fields to which the reports relate. As the different experimental projects are completed reports will be presented in scientific publications and in technical bulletins. Since our first series of reports a considerable volume of work has in fact been so published.

In presenting this series of reports we wish to gratefully acknowledge the assistance received from the Minister for Agriculture and the staff of the Department of Agriculture; the University authorities; Comhlucht Siuicre Eireann Teo., the advisory services and the various rural organisations. We have also been greatly helped by the support and co-operation of many organisations and research workers from outside the country.

T. Walsh
Director

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INTRODUCTION

The function of the Plant Sciences and Crop Husbandry Division is to conduct research which will form a background for the production of crops giving the best possible yields of high quality.

With this aim in view, the resources of the various disciplines of plant breeding, genetics, chemistry, parasitology and crop husbandry have been combined. The Division consists of the following departments and units:

Plant Breeding, Cereal Chemistry, Nematology, Crop Husbandry, Plant Pathology, Plant Chemistry and Biochemistry, and Applied Plant Genetics.

By arrangement with the Irish Sugar Company the headquarters of the division are located at Thurles. Here also the breeding and cytology of sugar beet are conducted together with the chemical analyses of beet from field trials and breeding material.

During the year considerable changes and developments occurred.

Oakpark: Extensive experimental and research work was begun at the newly acquired Oakpark Station where a large section of the Plant Breeding Department was established. Work commenced on the breeding of fodder beet, swedes, kales, rape, potatoes, grasses and clovers.

The Crop Husbandry Department, also established at Oakpark, has commenced an extensive programme of investigations into the problems of cultivations, fertiliser applications, plant physiology and chemical weed control.

The Plant Chemistry and Biochemistry Department has now been equipped to undertake fundamental chemical research on plants and plant products.

Kinsealy: The Cereal Chemistry Department transferred to its newly built laboratory at Kinsealy, where it will have much improved facilities to conduct quality tests on wheat, barley and oats.

The Nematology Department has also been provided with a new laboratory at Kinsealy. The staff of this department at present working at U.C.D. experimental farm, Glasnevin, will transfer to Kinsealy as soon as the laboratory has been equipped. The new facilities will enable large numbers of samples to be dealt with expeditiously.

The Plant Pathology Unit continues work at Glasnevin under the general direction of the Head of the Plant Pathology Department, University College, Dublin. Here the staff has been investigating diseases of cereals, root crops, soft fruit and vegetables.

The Applied Plant Genetics Unit has been set up at Townley Hall, Drogheda, in co-operation with Trinity College, Dublin. As soon as facilities can be provided a study will commence on fundamental genetics of crop plants and on the effects of irradiation and chemical mutagens in accelerating production of mutations.

Many of the research projects call for the combined efforts of staff in two or more departments. There is also close collaboration between these departments and the other research divisions of An Foras Taluntais.

The reports which follow give a general account of the work in progress.

B. Crombie

PLANT BREEDING DEPARTMENT

SUGAR BEET

Variety Trials

Nine variety field trials to test family groups, strains and varieties, were laid down. In seven of these trials 22 varieties were tested on soils representing those in beet cultivation throughout the country and one very large field trial included 121 family groups, strains and varieties. Twenty varieties from sugar beet seed producing companies in U.S.A., England, Germany, Denmark, the Netherlands and Sweden were also included in these trials. The range of performance of the different varieties in the trials was quite wide, with some of the newly-produced polyploids being much superior to all other varieties in both yield and sugar content. A very interesting feature which emerged from the trials was the fact that tetraploids often yielded better than diploids and had a much higher sugar content; they sometimes equalled polyploids in both these respects and in a few cases surpassed them and all other varieties in the field in both yield and sugar content.

Bolting Trial

A bolting trial comprising 118 strains, family groups and varieties and having an area of 5½ acres was sown on March 10.

Weather and soil conditions favoured the early sowing and the soil temperature was such that all strains, family groups and varieties emerged within 14 - 16 days. There was considerable bolting in most strains, the incidence ranging from 0.8 per cent to 57.4 per cent. The high incidence of bolting in the field in 1961 could be attributed to late frosts, the last severe frost being on May 27. Singled roots and stecklings from this trial will provide outstanding material for breeding top class bolting-resistant strains.

Low-Temperature Germination

The work of improving strains for germination at low temperatures in harsh spring weather continued. Seeds of selected bolting-resistant strains were put to germinate at 40° F - 42° F; the first 3 percent of the seedlings capable of emerging at this temperature being grown on for further propagation.

A number of low temperature germinating selections was included in the bolting trial sown on March 10. As the soil temperature was unusually high for that time of year, the low temperature germinating selections showed only slight superiority of emergence over strains not so selected - their acceleration of emergence being not more than one or two days. However, it was quite noticeable that the low temperature germinating selections showed much more vigour than the other varieties in the field.

Time of Sowing Trial

A time of sowing trial, five sowings at 2-week intervals from March 15, was laid down to determine the optimum sowing date for sugar beet under Irish conditions.

The layout was a randomized block having 20 varieties replicated eight times, four replications for early harvesting and the remaining four for late harvesting. While no definite conclusions can be drawn from the past year's results, it appears that the last week in March or the first week in April is the most suitable time for sowing sugar beet. In all cases the performance of diploid, triploid and tetraploid varieties was best when sown on March 29. These results agree with those of previous experiments carried out by Comhlucht Siuicre Eireann, Teo. Yields for the five individual sowings are shown in Table I *(overleaf)*.

It is generally believed that polyploids require a longer growing season than diploids. This may be true for more northerly latitudes, such as Sweden and Finland, where polyploids do not reach their full potential due to the rather short growing season. However, it seems that in Ireland polyploid performance is best when sown, not very early in March, but rather towards the end of March or beginning of April.

TABLE I
(Average yield of 5 individual sowings)

Date of Sowing	Date of Harvest	Yield/ac. Tons	Sugar %	Sugar/ac cwt
March 15	E*	14.74	15.1	44.5
" 15	L**	14.72	15.2	44.7
March 29	E	16.08	15.0	48.2
" "	L	16.78	15.1	50.7
April 18	E	12.98	14.5	37.6
" 18	L	14.59	14.7	42.9
April 28	E	14.04	14.7	41.3
" 28	L	13.39	14.8	39.6
May 15	E	11.6	14.4	33.4
" 15	L	12.17	15.2	37.0

* E = early harvesting

** L = late harvesting

Polyploid Breeding

The better autotetraploid lines, induced by colchicine treatment from some outstanding diploid strains and varieties, and having been stabilised, were used in a series of test crosses with high quality diploids. The polyploids so produced, containing from 45 - 60 percent triploids, yielded better than diploids while at the same time they had a much higher sugar content. The bolting resistance of polyploids was also superior.

In 1959 and 1960 detailed ploidy analyses were conducted on 28 polyploid strains. The average ploidy percentage for the polyploid strains in 1959 was 27 diploid, 51 triploid and 22 tetraploid. The average ploidy percentage for the polyploid strains in 1960 was 33 diploid, 52 triploid and 15 tetraploid.

The results showed conclusively that in polyploid populations, tetraploids, though very high in sugar content, were very small in root size and consequently low in yield when compared to the diploids and triploids grown beside them. This was in striking contrast to the results obtained in the field trials when pure tetraploids compared very favourably with diploids and even with polyploids.

Polyploid Component Trial

To determine what factors are responsible for suppression of tetraploids in a polyploid population an elaborate polyploid component trial was laid down. The results of this trial are shown in Table II.

TABLE II

Key	Ploidy	Pure or in Combination (C)	Yield of roots per acre Tons	Yield of roots from combined ploidys per acre Tons	Sugar %	Yield of Sugar per acre cwt	Yield of sugar from combined ploidys per acre cwt
A	Tetraploid	Pure	14.71		18.2	53.7	
B	Diploid	Pure	15.14		17.4	52.7	
C	Diploid	C with 4N	19.42	14.56	16.9	65.8	49.8
C	Tetraploid	C with 2N	9.71		17.4	33.8	
D	Triploid	Pure	16.42		16.7	54.9	
E	Triploid	C with 4N	20.57	15.42	16.5	68.0	51.7
E	Tetraploid	C with 3N	10.28		17.2	35.4	
F	Diploid	C with 3N	17.42	15.42	17.1	59.6	52.3
F	Triploid	C with 2N	13.42		16.9	45.4	

Table II strongly indicates that tetraploids grown pure can yield as well as diploids but that when combined with either diploids or triploids they are seriously suppressed, giving a reduced yield.

Experiment on ploidy ratios in Polyploids

An experiment was carried out to determine the most suitable blend of tetraploid and diploid stecklings for the production of polyploid seed with the maximum amount of triploids. Results are shown in Table III.

TABLE III

PARENT PLANTS		PLOIDY RATIOS IN SEEDLINGS FROM THE RESULTING SEED CROP		
4N	2N	2N%	3N%	4N%
75	25	13.6	53.9	32.5
70	30	30.9	47.2	21.9
65	35	40.8	50.4	8.8
60	40	37.7	49.8	12.5
50	50	61.9	27.0	11.1

It can be observed from Table III that polyploids having approximately 50 percent triploids were produced when the tetraploids in the parent mixtures ranged from 60 - 75 percent.

B. Crombie
L.J. O'Connor

MONOGERM BREEDING

Monogerm sugar beet breeding work was continued with the object of improving existing monogerm strains to the quality of commercial sugar beet seed.

Lines of seed from the 1960 harvest were sown as an observation plot and to provide breeding material for 1962. Five monogerm lines were sown in a field trial and though most were low in yield with fair sugar percentages, one line yielded well. A summary of results is shown in Table IV.

TABLE IV

	Lines	Yield of roots (tons/acre)	% Sugar	Cwt. sugar per acre
Group 860	Mono 2N	11.44	15.6	35.6
Group 960	Mono 2N	10.84	15.3	33.1
Comp 4660	Mono 4N	11.72	15.5	36.5
Comp 4760	Mono 4N	14.28	15.6	44.6
Comp 5060	Mono 2N	12.00	14.4	34.6
Irish Comm. Lot 386C	Control	14.28	15.5	44.1
Field Average		14.42	15.9	45.9

A tetraploid line, Comp. 4760, yielded as well as the control variety, with a slightly higher sugar percentage and sugar per acre, and almost equalled the average for the field. Comp. 5060 is the diploid equivalent of Comp. 4760, and is the most promising diploid available for development. More advanced versions of this line will be tested in field trials in 1962.

By utilising these and the other lines, monogerm polyploids will be produced in various combinations in 1962. Polyploids offer the quickest means by which monogerm lines can be brought up to a high level of productivity. A monogerm diploid/triploid mixture can be obtained by crossing diploid monogerm to tetraploid multigerm, and harvesting off monogerm alone, to produce F_1 monogerm commercial seed. The reciprocal cross using tetraploid monogerm and diploid multigerm can also be made. This has the additional advantage of giving a final boost of high quality multigerm material to the monogerm line.

Monogerm F_1 lines were raised in glasshouse compartments at Thurles, utilising American monogerm male sterile, as received and without selection, to test this for combining with Irish breeding material and for yielding ability. Diploids and triploids were produced in this manner, pollinating the monogerm male sterile with diploid and tetraploid multigerm strains. These lines will be tested in field trials in 1962.

204 crosses, consisting of F_1 crosses of monogerm to multigerm and F_2 families of monogerm crossed to multigerm, were raised in polythene cages. Families of monogerm selfings were also raised. The glasshouses at Mallow were also used for raising hybrid monogerm crossed to multigerm families and F_2 families.

8 monogerm F_2 segregating lines were planted in isolation in elite seed selection plots and the multigerms were cut out, leaving the monogerms to inter-pollinate and to yield pure monogerm seed. These lines will be tested in field trials in 1962. Most of the lines yielded from 12 - 20 percent monogerm plants but one self-fertile line yielded 32 percent. Monogerm plants were also selected from these segregating populations and used in back-crosses in polythene cages. 5 monogerm F_1 lines were also grown in elite seed plots.

J. B. MacLachlan, P. Fitzgerald.

MALE STERILE BREEDING

Male sterile strains are being developed so that it will be possible to produce 100 percent F_1 triploid commercial seed, thus obtaining the fullest advantage from heterosis and the superior yielding ability of triploids.

Work on male sterile breeding is at present concentrated on isolating Type O plants, so that a Type O strain can be developed for crossing to a male sterile to produce an entirely male sterile strain. This work was intensified with the use of annual male steriles as the female parent in the Type O test crosses for the first time in 1961. Annuals were selected for their more rapid bolting and, consequently, earlier availability of results. Seed from these crosses was sown last autumn but has not yet bolted.

Pollen donors in these Type O test crosses include multigerm diploids and tetraploids, and monogerm lines, though continual

selection for monogerm Type O will have to be made as the monogerm improves in quality. Also tested was selfed progeny of previously tested plants that appeared to be Type O or highly Type O. Over 400 of these were tested in bag crosses in 1961.

In addition, biennial male steriles are being maintained and improved in quality by top-crossing to multigerm diploid pollen donors, so that they will be ready for immediate use when Type O strains are available.

An American multigerm male sterile was also used in crosses to Irish multigerm diploid and tetraploid beets to raise F_1 diploid and triploid lines to test for yielding ability. These lines will be tested in field trials in 1962.

Experiments on the chemical induction of male sterility in sugar beet have been discontinued as it is not thought that it has any practical application to sugar beet breeding.

J. B. MacLachlan, P. Fitzgerald.

BREEDING FOR RESISTANCE TO DOWNY MILDEW

Monogerm sugar beet on which development work is being carried out in this country originated in America and, since this material was bred under different conditions to those obtaining here, it generally had some drawbacks such as poor bolting or disease resistance. Monogerm seed lots were especially noted for susceptibility to downy mildew in this country. For this reason a programme of breeding for resistance to downy mildew has been started. Work is initially being carried out on multigerm beets and monogerm lines will not be included until they have been further developed for yielding ability. However, the susceptibility of monogerm breeding lines to downy mildew is being observed.

Roots of 4 multigerm diploid and tetraploid lines that had previously been noted and selected for resistance to downy mildew were planted and bag crosses and selfings were made on them. The resulting seed was delivered to the Plant Pathology Department for seedling inoculation with downy mildew spores. This seed was made available in December, and has been growing in the glasshouses at Kinsealy over the winter. Results are not yet available but it is intended to select the most resistant lines and breed from these. A total of 183 selfings and 76 2-plant crosses was sown.

Also being tested are open pollinated seed of the strains these lines originated from, and monogerm breeding lines.

J. B. MacLachlan, P. Fitzgerald.

TRISOMICS

Aneuploids have been raised by pollinating triploid male steriles and an attempt is being made by cytological examination to isolate trisomics.

There are nine possible trisomics in sugar beet, and if they could all be found they would add to research and increase knowledge of sugar beet genetics.

J. B. MacLachlan.

ROOT AND FODDER CROPS

Root and fodder crop variety trials were carried out in 1961 at Oakpark, Moorepark, Johnstown Castle and at the Department of Agriculture Schools at Athenry, Ballyhaise and Clonakilty.

Fodder Beet and Mangels

Twenty varieties, which included 13 of fodder beet, six of mangels and one of sugar beet, were sown in the trials. Due to the dry weather at sowing time yields were well below those of last year Summary of the results is given in Table V.

TABLE V

VARIETY	DRY MATTER PER CENT	YIELD OF ROOTS tons/acre	YIELD OF DRY MATTER tons/acre
Sugar Beet	22.7	11.7	2.66
FODDER BEET			
Hinderupgaard XII	18.8	14.8	2.78
Voedersuikerbeit C.B.	18.7	15.3	2.86
Hunsballe XII	18.6	14.3	2.66
Pajbjerg Rex XII	18.2	15.0	2.73
White Otofte XII	18.1	15.1	2.73
Red Otofte XII	17.5	15.5	2.71
Groenkragg C.B.	16.7	16.8	2.81
Eureka	16.4	16.6	2.72
Bison	15.6	17.7	2.76
Yellow Daeno XII	14.6	18.4	2.69
Pajbjerg Korsroe XII	14.5	20.2	2.93
Barres Otofte Nova XII	14.0	18.9	2.65
Pajbjerg Ideal XII	13.8	21.6	2.98
MANGELS			
Half Sugar Rose	12.1	20.4	2.47
Yellow Intermediate	10.3	24.9	2.56
Red Intermediate	9.9	26.3	2.60
White Knight	10.3	26.0	2.68
Yellow Globe	9.9	26.7	2.64
Lord Warden	10.2	24.0	2.45

Swede Trials

Purple, bronze and green skinned types were included in the twenty varieties under trial. Summary of results is given in Table VI.

TABLE VI

VARIETY	DRY MATTER PER CENT	YIELD OF ROOTS tons/acre	YIELD OF DRY MATTER tons/acre
Purple Skin Group			
Best of all	9.3	28.7	2.67
Tipperary	9.3	29.0	2.70
Magnificent	9.2	29.3	2.70
Superlative	9.1	29.0	2.64
Monarch	9.4	27.0	2.54
Acme	9.0	28.4	2.56
Broadlard	9.0	32.8	2.95
Warrington	9.0	29.4	2.65
Doon Spartan	10.4	27.1	2.82
R.34 Swede	9.6	27.6	2.65
Peerless	9.1	30.4	2.77
Townhead Purple Top	9.0	29.3	2.64
Champion Purple Top	9.2	28.5	2.62
Bangholm Otofte XI	10.4	27.8	2.89
Bangholm Wilby Otofte XI	11.0	27.2	2.99
Bronze Skin Group			
Parkside Bronze Top	8.3	29.7	2.47
Conqueror	9.8	26.1	2.56
Green Skin Group			
Wilhelmsburger Trifolium XI	10.3	28.1	2.89
Wilhelmsburger Otofte XI & F.	9.7	30.3	2.94
Green Top	10.3	27.6	2.84

Kale Trials

The assessment of the relative agronomic merits of strains of marrow stem and thousand head kale continued. Thirteen strains of marrow stem and 12 of thousand head from commercial sources in England and Ireland were under test. There were variations between the strains of marrow stem in both total yield and yield of leaf. Two strains gave about 10 percent higher yield than most of the others while a purple strain gave the lowest yield.

There were smaller variations between the thousand head strains. Canson kale yielded as well as thousand head and had a higher percentage of leaf. This type is very suitable for late feeding on account of its low growing habit, high yield of leaf and its very good winter hardiness.

Some commercial continental kales were also under test. Many of them gave a large yield of leafy material and were somewhat intermediate between marrow stem and thousand head types.

Kale wastage on grazing

A trial was carried out at Oakpark to determine the amount of wastage which occurs when kale is grazed in situ. Thousand head, canson and two strains of marrow stem were under test.

Using an electric fence, the kale was strip-grazed by 20 two-year-old bullocks. A fresh fold was allotted each day except on the first few days when the animals were reluctant to eat the kale. The bullocks were allowed a daily ration of 40 - 50 lb each and grazing lasted from November 17 to December 7. The plants were grazed to within six inches (approx) of the ground.

There were big variations in wastage between the plots, ranging from 5 - 30 percent: the average figure was between 15 and 20 percent. Generally the amount of leaf wasted was greater than that of stem. There was no significant difference in wastage between the different types of kale.

Kale Breeding

Work commenced on breeding of marrow stem kale. Inbreeding and the production of double cross hybrid varieties, which have

been so successful in maize breeding, offer the best possibilities of producing superior varieties and will be used in the present programme together with pair crossing.

The present aims are to produce leafier, more frost resistant and more productive strains of marrow stem kale than those at present available.

The best plants obtainable were selected in January 1961. They were bud pollinated to produce inbreds and also four plants as males were crossed to all the other plants. Seed from the inbreds and crosses were sown in June and these first generation inbreds have been studied in the field.

Considerable variation was evident among the inbreds and crosses. The severe frosts in December and January provided a very stringent test for the winter hardiness of all the lines, and approximately 75 percent of the plants were killed.

The nine best inbred lines have been selected and all possible crosses between them will be made in March 1962. Plants from the best pair crosses have also been selected and more pair crosses will be made between these good plants.

Fodder Beet Breeding

The present programme aims at producing hybrid fodder beet seed utilising both cytoplasmic and mendelian male sterility.

Two hundred Type O test crosses were made in ventilated polythene cages between Yellow Daeno XII fodder beet and male sterile sugar beet. From these crosses it is hoped to identify some Type O fodder beets. Backcrossing the hybrids to the Type O for five generations should give a male sterile fodder beet equal in yielding ability to normal fodder beet. This male sterile fodder beet may then be used to produce diploid hybrid fodder beet seed or triploid seed by crossing tetraploids with the male sterile diploids.

D. P. Feeley

POTATOES

The aim of the potato breeding programme is to produce high yielding varieties of good quality with greater resistance to disease, especially to *Phytophthora infestans*. The greater part of the work during the year was concentrated on:

(a) Collection of breeding material

(b) Trials on a large number of varieties to assess their yielding capacity, disease resistance, commercial value and suitability for use in breeding work

(a) Collection of breeding material *

During the year samples of 270 varieties or unnamed seedlings were collected. Of these, 226 were named varieties, the remainder being "blight differentials" and unnamed seedlings with specific resistance to root eelworm, blight, viruses or other diseases and pests. These, together with other varieties of special value, were obtained from the Scottish Plant Breeding Station, Pentlandfield.

Of the named varieties, 79 were virus-free and three tubers of 73 of these collected in spring were grown in isolation on a farm in the Wicklow mountains. The object was to keep them in their initial virus-free condition during propagation and to have sufficient quantity of each available in 1962 to stock a breeding plot at Oakpark and a propagation plot of virus-free varieties in Wicklow. A small amount of breeding work was carried out on these varieties in 1961 and their value for breeding purposes was assessed.

Of the remainder of the named varieties, 123 are old ones that have gone out of cultivation in this country. All the varieties and seedlings are being assessed and the most suitable will be used for breeding.

(b) Variety Trials

(1) Early and (2) Maincrop varieties

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* The co-operation of the Department of Agriculture, Plant Pathology Department, University College, Dublin, Ceimici Teoranta, and the Scottish Plant Breeding Station in the collection of this material is gratefully acknowledged

(1) Early potato variety trials

Two trials on early varieties were carried out at the Pomology Research Station. The objects were (i) to compare the rate of tuber development in a number of first and second early varieties at different stages of growth and also to find the effect of sprouting the seed in fluorescent light compared with sprouting under natural light in a well-lighted building, and (ii) to make observations on the varieties to determine their value for breeding.

Half the required amount of seed of each variety was sprouted in natural light while fluorescent light or "barn sprouting" was used for the remainder.

(a) First early potato variety trial

The varieties Arran Pilot, Home Guard, Epicure, Ulster Premier and Ulster Chieftain were compared using the two methods of sprouting described. Date of planting - March 9. Harvestings were carried out at three stages of growth: the first was on June 16 and the others followed at seven day intervals. Arran Pilot gave the highest marketable and total yields at the first harvesting while Epicure gave the highest marketable yield at the second and third harvestings. There was considerable variation between yields from the two sprouting treatments, the effect varying with the variety and date of harvesting.

(b) Second early potato variety trial

The varieties Ulster Dale, British Queen, Craig's Royal, Dunbar Rover and Arran Pilot were compared using the two sprouting treatments described. Date of planting - March 16. Harvestings were carried out at four stages of growth: the first was on June 23 and the others followed at seven day intervals. At each harvesting the yields of marketable potatoes and chats were recorded. Arran Pilot gave the highest yield at the first, second and fourth harvestings, while Ulster Dale gave the highest yield at the third. Dunbar Rover gave the lowest yield throughout.

(2) Main crop varieties

(a) Maincrop potato variety trial No. I.

Object: To compare a number of varieties reputed to be resistant to blight with some common susceptible ones in regard to yield, resist-

ance to disease, especially to *Phytophthora infestans*, quality, grading suitability for use as breeding material and also suitability for industrial processing.

This trial was carried out on ten varieties at four centres: Johnstown Castle, Moorepark, Oakpark and at the Department of Agriculture's School, Athenry. There were four replicates at each centre. At Oakpark the plots were divided: one half was sprayed three times with Burgundy mixture at fourteen day intervals to control blight while the other half was not sprayed. Some results of this trial are given in Table I. The trial received normal cultural treatment at the other centres, being sprayed at least three times to control blight.

A summary of results from the other centres is given in Table II. Arran Banner gave the highest total yield while Kerr's Pink gave the highest marketable yield.

Grades used were: Ware over 2¼": Seed 1¼" - 2¾": Chats under 1¼".

(b) Maincrop potato variety trial No. 2 (Oakpark)

Object: To compare a number of varieties with Kerr's Pink in regard to yield, quality, grading and disease resistance, and to determine their commercial value and suitability for use in breeding work.

There were four replicates of each variety. The trial received normal cultural treatment and was sprayed three times at 14 day intervals to control blight. Some results are given in Table III.

Ulster Supreme gave the highest marketable (ware + seed) and total yields but it also had the second highest yield of blighted tubers.

The specific gravity, dry matter and quality tests on the varieties in the above two trials were carried out at the Research Laboratory, Comhlucht Siuicre Eireann Teo.

Observation Plots: Observation plots were laid down with blight indicator varieties. These were planted at five centres - Moorepark, Johnstown Castle, Athenry, Oakpark and on a farm in Co. Laois, in conjunction with the Plant Pathology Department, University College, Dublin. The object was to find the races of blight in the different areas. Preliminary results indicate the predominance of races 4 and 1, 4 at each centre. This work is being continued as it is important in connection with breeding for resistance to blight.

H.W. Kehoe

TABLE I

SPRAYED[1] *Yields are given in tons/acre*

VARIETY	YIELD OF WARE	YIELD OF SEED	YIELD OF CHATS	YIELD OF BLIGHTED TUBERS	YIELD OF SECOND GROWTH TUBERS	YIELD OF GREEN TUBERS	YIELD OF TUBERS DAMAGED IN HARVESTING	SPECIFIC GRAVITY	% DRY MATTER	TOTAL YIELD	MARKETABLE (WARE + SEED) YIELD
Arran Banner	6.83	3.35	0.15	3.40	-	0.02	0.32	1.080	22.25	14.07	10.18
Kennebec	6.40	3.68	0.18	0.88	0.12	0.23	0.74	1.087	21.68	12.23	10.08
Voran	1.93	8.97	0.48	0.35	-	-	0.26	1.090	23.2	11.99	10.90
Ulster Torch	4.99	5.04	0.17	2.45	-	0.06	0.31	1.085	20.7	13.02	10.03
Dekama	5.77	6.98	0.31	0.07	-	0.06	0.22	1.093	24.4	13.41	12.75
Ambassadeur	1.79	8.14	0.54	0.34	-	0.02	0.17	1.103	24.18	11.00	9.93
Libertas	4.64	7.27	0.33	0.24	0.98	-	0.11	1.089	23.23	13.57	11.91
Alpha	9.05	5.36	0.13	0.46	0.04	0.06	0.40	1.082	21.95	15.50	14.41
Kerr's Pink	4.71	8.20	0.33	1.01	-	-	0.30	1.080	22.58	14.55	12.91
Bintje	3.00	6.99	0.40	1.27	0.02	-	0.30	1.081	22.28	11.98	9.99

UNSPRAYED [2] TABLE II

Arran Banner	4.99	2.82	0.14	2.73	0.02	0.01	0.38	1.079	21.50	11.09	7.81
Kennebec	7.97	3.04	0.10	0.88	0.07	0.36	0.43	1.092	23.18	12.85	11.01
Voran	2.03	10.46	0.48	0.32	-	0.02	0.25	1.088	23.00	13.57	12.49
Ulster Torch	5.63	4.85	0.17	3.89	-	-	0.37	1.084	21.70	14.91	10.48
Dekama	6.14	6.21	0.23	0.04	0.02	0.02	0.17	1.095	23.80	12.83	12.35
Ambassadeur	2.14	7.71	0.48	0.38	-	0.01	0.15	1.103	24.80	10.87	9.85
Libertas	3.11	8.17	0.36	0.41	0.91	0.01	0.13	1.084	21.55	13.10	11.28
Alpha	5.19	6.59	0.18	1.08	0.01	0.04	0.32	1.088	23.03	13.41	11.78
Kerr's Pink	4.20	6.76	0.23	1.66	-	-	0.15	1.080	22.23	13.00	10.96
Bintje	1.88	6.55	0.42	2.26	0.01	0.02	0.27	1.080	21.10	11.41	8.43

1 = SPRAYED THREE TIMES AT 14 DAY INTERVALS WITH BURGUNDY MIXTURE TO CONTROL BLIGHT

2 = NOT SPRAYED WITH BURGUNDY MIXTURE

TABLE II

AVERAGE RESULTS OF THREE CENTRES

(Yields are given in tons per acre)

VARIETY	YIELD OF WARE	YIELD OF SEED	YIELD OF CHATS	YIELD OF BLIGHTED TUBERS	YIELD OF DISEASED OTHER THAN BLIGHT	YIELD OF SECOND GROWTH TUBERS	YIELD OF TUBERS DAMAGED IN HARVESTING	YIELD OF GREEN TUBERS	% DRY MATTER	SPECIFIC GRAVITY	TOTAL YIELD	MARKETABLE (WARE+SEED)
Arran Banner	7.80	4.83	0.29	0.98	0.07	0.01	0.17	0.10	22.23	1.087	14.25	12.63
Libertas	2.23	7.51	0.53	-	0.06	0.11	0.03	0.06	26.08	1.108	10.53	9.74
Dekama	5.11	7.43	0.58	-	0.03	0.01	0.08	2.23	25.44	1.104	13.47	12.54
Ulster Torch	2.62	7.57	0.48	0.37	0.07	-	0.20	0.09	23.93	1.097	11.40	10.19
Bintje	0.77	8.55	1.42	0.63	0.03	-	0.02	-	23.28	1.093	11.42	9.32
Alpha	3.63	7.93	0.39	0.15	-	0.01	0.05	0.07	25.04	1.103	12.23	11.56
Voran	2.07	7.90	1.18	0.04	-	0.01	0.02	0.03	24.59	1.099	11.25	9.97
Kennebec	7.10	3.97	0.23	0.08	0.10	-	0.11	0.39	22.98	1.091	11.88	11.07
Kerr's Pink	4.06	8.63	0.59	0.21	0.02	-	0.05	-	23.57	1.096	13.56	12.69
Ambassadeur	0.71	6.49	1.27	-	0.04	-	0.01	0.08	26.55	1.111	8.60	7.20

TABLE III

(Yields are given in tons per acre)

VARIETY	YIELD OF WARE	YIELD OF SEED	YIELD OF CHATS	YIELD OF BLIGHTED TUBERS	YIELD OF DISEASED OTHER THAN BLIGHT	YIELD OF SECOND GROWTH TUBERS	YIELD OF TUBERS DAMAGED IN HARVESTING	YIELD OF GREEN TUBERS	% DRY MATTER	SPECIFIC GRAVITY	TOTAL YIELD	MARKETABLE (WARE+ SEED)
Ulster Commerce	6.17	7.11	0.25	0.37	-	0.02	0.24	0.65	22.38	1.085	14.81	13.28
Up to Date	3.96	7.67	0.26	1.78	-	-	0.82	0.21	21.85	1.082	14.70	11.63
Golden Wonder	1.42	10.90	0.43	-	.01	0.11	0.12	-	24.60	1.093	12.99	12.32
Kerr's Pink	5.97	7.98	0.19	1.58	-	0.01	0.25	0.03	20.80	1.079	16.01	13.95
Dr. Mclotosh	5.40	9.87	0.34	0.35	-	0.02	0.59	0.11	20.65	1.078	16.68	15.27
Arran Peak	8.10	5.42	0.12	0.21	-	0.02	0.46	0.33	21.00	1.081	14.66	13.52
Ulster Beacon	7.05	5.37	0.15	1.09	0.04	0.05	0.44	1.23	21.55	1.080	15.42	12.42
Arran Victory	3.22	9.71	0.35	0.22	-	-	0.55	0.02	22.3	1.086	14.07	12.93
Ulster Tam	5.82	7.23	0.14	0.31		-	0.55	0.60	21.6	1.083	14.65	13.05
Ulster Supreme	7.63	7.77	0.28	2.68	-	-	0.40	0.24	20.98	1.087	19.00	15.40
Record	4.65	10.06	0.29	0.04	-	-	0.21	0.17	23.58	1.095	15.42	14.71
Spry's Abundance	8.26	6.35	0.25	2.84	0.04	0.01	0.25	0.12	22.45	1.083	18.12	14.61
Skerry Champion	4.95	3.38	0.20	1.96	-	0.03	0.11	0.54	22.70	1.090	11.17	8.33

GRASS BREEDING

Selection Programme

Much of the work so far has been concerned with initial selection of plants in the spaced-plant nursery, and collection of indigenous material on a more extensive scale. Tillers of ryegrass, cocksfoot and timothy were collected from old pastures in counties Waterford, Cork and Tipperary in spring. In August seed heads were collected from areas which provided the most promising material.

All this material has been planted out as single plants at 2 x 2 ft spacing. Inter-plant competition at such wide spacing is extremely low compared to that in dense plant population of a sward; it is not surprising, therefore, that production in terms of annual output under sward conditions can not be predicted from spaced plant performance with any reliable degree of accuracy. However, such characters as earliness, seasonal production pattern, autumn-winter growth, leaf/stem ratio and disease resistance can be estimated from spaced plants; it is on this basis that initial selection is made.

The best mother plants are propagated vegetatively and isolated in a polycross plot; sufficient seed can be obtained to assess the agronomic potential of the mother plants on the basis of the performance of their polycross progeny. This test will be included as early as possible in the selection programme.

Single plants will in future be planted out at higher densities in order to increase the inter-plant competition in the breeding plot.

Perennial Ryegrass

From the plant collection made in 1960 some 80 potential mother plants have been selected and propagated vegetatively; these clones will be planted out for further observation. In addition, the 20 best plants have been isolated in a polycross plot. Samples of each of 60 polycross progenies * have been planted out for observation.

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* These polycross progenies have been received from the Department of Agriculture

Cocksfoot

Selections of cocksfoot from indigenous material have been made and some promising plants have been obtained; these have been clonally divided and the best 15 will be isolated in a polycross plot this year.

Tall Fescue

Samples of Tall Fescue from F.A.O. have been planted out, some of which are of considerable interest because of their growth during late winter. It is intended to plant out considerably more material from the most promising ecotypes before selections are made.

Ryegrass - Fescue hybrids

Among the plants collected from old pastures in 1960 there were some (25) plants which showed characteristics of the hybrid *L. perenne x F. pratensis*, i.e. *Festuca loliacea* (Huds.). All plants had lax or slightly branched inflorescences, lower spikelets in most cases were borne on very short pedicels and inner glumes were present in some cases. All these characters, especially the presence of inner glumes, showed some variation from plant to plant.

The hybrid nature of these plants was further borne out by pollen stains, the percentage of normal pollen grains being extremely low except for one plant which had about 30 percent fertile pollen; this however was not reflected in a higher seed set on open pollination. All seed heads from these plants were harvested after open pollination among ryegrass plants. Most of the plants set some heavy seed and these will be germinated later.

Some of the hybrids were very vigorous and possessed many desirable agronomic characteristics; it is intended to backcross these plants to selected perennial ryegrass plants in an attempt to obtain fertile types while retaining the desirable characters of the hybrid.

Clover Breeding

One species, *Trifolium repens*, is being investigated. The chief aim is to breed a type which will grow at lower temperatures than do those strains at present available.

Collections of native ecotypes have been made. These plants are all of the small or medium leaf-size groups; little variation could be detected in the earliness of growth of the individual plants. Samples of white clover have been obtained from various European countries, and from these it may be possible to obtain types which will begin growth at a lower temperature than that required by our native material.

V. Connolly

CYTOLOGY UNIT

The work was concerned mostly with the cytology of *Beta vulgaris*. It comprised the mitotic examination of seedlings and mother roots, the treatment of seedlings to induce tetraploids, and meiotic examination of polyploid and aneuploid inflorescences.

Other cytological work involved the testing of grasses, *brassicae* and fodder beet and the inducing of tetraploids in *Festulolium loliaceum*, *Lolium multiflorum* and fodder beet.

BETA VULGARIS

1. Polyploid Screening Tests

From a decorticating and screening experiment, 6,900 seedlings were examined to determine their ploidy distribution. Four different strains of polyploid seed were used in this experiment and the following samples were tested from each strain:-

1. General Sample
2. Over 6.1 mm
3. Under 6.1 mm
4. Screenings from 2.8 mm to 8.33 mm and over

The results (Tables V - VII) show that the four strains reacted differently to screening.

2. Polyploid Mother Roots

3,000 mother roots, comprising 100 roots from each of 30 polyploid strains, were checked cytologically. Before checking, these roots had

been chemically analysed in the beet laboratory to see what relationship, if any, existed between the different ploidy groups and yield, sugar content, and other aspects of beet quality.

3. Induced Tetraploids

Plants from five batches of seeds which had been treated by colchicine, using both the American and Swedish methods of treatment, were given their final checking for ploidy. A total of 700 samples was examined, giving 147 tetraploids.

The Swedish method, used by Hilleshog, consists of spraying the young seedlings with 0.4 per cent colchicine on the first morning they emerge. They are then left without water until the following morning when the excess colchicine is washed away by watering. The American method, used by Helen Savitsky, involves the germination of seed clusters on filter paper, and transferring the germinated clusters to a solution of 0.3 percent colchicine for a period of five hours. The seedlings are then washed and sown in pots.

The results of both treatments were disappointing, presumably due to very hot weather while the plants were being treated. The Swedish method gave a 2.51 percent reaction as compared to 1.56 percent for the American method. The experiment will be repeated in 1962 and treatment will be carried out in the spring when glasshouse temperatures will be lower.

4. Glasshouse Compartments

Fourteen glasshouse compartments were planted with tetraploid mother roots for seed production and checked to ensure that all were pure tetraploids. This involved testing of the 560 roots in the compartments and some extra roots as replacements.

5. Isolation Plots

Nineteen isolation plots, which had been planted with mother roots and stecklings for tetraploid seed production, were checked to ensure that all plants were pure tetraploids. This involved the checking of 4,400 samples. The non-tetraploids were removed.

6. Inducing of Tetraploids

The Swedish method was used to induce tetraploids in five lots of monogerm seed. One lot was pure American monogerm and the other four lots were of B_1 - American monogerm back-crossed with Irish multigerm. These were given their first cytological checking - which involved 900 plants.

7. Polyploid Component Trial

The results of the chemical and cytological analyses of polyploid mother roots in 1960 showed that even though tetraploids are capable of giving high sugar content when grown in a polyploid variety, their yield is poor. This gave rise to a polyploid component trial in which a diploid, a triploid and tetraploid strain of seed were sown pure and in the three possible combinations. The chemical analyses of the resulting roots were conducted in the beet laboratory and the crowns were checked cytologically to ensure that the ploidys were correct. This involved the checking of 540 samples.

8. Polyploid and Aneuploid Infloresences

Work commenced on the meiotic examination of polyploid and aneuploid inflorescences and will be continued during 1962. The aneuploids are being checked cytologically to isolate trisomics.

FODDER BEET

1. Diploid Fodder Beet

Two lots of fodder beet were checked to ensure that they were pure diploids.

2. Inducing of Tetraploids

One lot of diploid fodder beet was sown in pots and treated with colchicine using the same Swedish method as that used for sugar beet. After morphological examination, the seedlings which had shown no reaction were given a further treatment of one drop of 0.5 per cent colchicine on the growing point every day for 10 days. The plants which responded to treatment were transplanted into boxes after two weeks and later checked cytologically. The first checking involved

1,260 plants.

Inducing of tetraploids in *Festulolium loliaceum* and *Lolium multiflorum*

Festulolium loliaceum

Single tillers were potted and given a 10-day treatment with colchicine by applying a drop each day to the growing point. These tillers will be left to set seed and the resulting seeds from each tiller will be examined. *Festulolium loliaceum* in the diploid form is sterile but it is hoped that, by tetraploidising it, it will produce seed.

Lolium multiflorum

Seeds of *lolium multiflorum* were placed in petri dishes and when germinated were treated with 0.25 per cent colchicine for 30 minutes. The seedlings were then washed and planted in individual small pots. They are being cytologically checked.

S. Forde
E. Dwyer

(Tables overleaf)

TABLE VI

STRAIN P 13

Sample	% Diploid	% Triploid	% Tetraploid	% Indefinite
General	12.2	50.0	20.7	17.1
Under 6.10 mm	24.7	38.9	23.5	12.9
Over 6.10	21.8	35.6	25.3	17.3
3.17 - 3.94	51.4	20.6	19.1	8.9
3.94 - 4.36	49.0	27.5	3.9	19.6
4.36 - 4.52	52.8	29.8	3.4	14.0
4.52 - 4.75	39.8	25.0	11.4	23.8
4.75 - 5.08	44.7	20.0	9.4	25.9
5.08 - 5.59	40.8	31.6	1.3	26.3
5.59 - 6.10	19.8	33.7	12.8	33.7
6.10 - 7.14	13.0	53.2	22.1	11.7
7.14 - 7.53	10.0	45.7	25.7	18.6
7.53 - 8.33	12.2	44.4	19.0	24.4
8.33 +	19.7	43.4	21.1	15.8

TABLE V

STRAIN P 6

Sample	% Diploid	% Triploid	% Tetraploid	% Indefinite
General	39.3	31.0	22.6	7.1
Under 6.10 mm	46.8	31.2	10.4	11.6
Over 6.10	8.8	50.9	31.4	8.9
2.80 - 3.05	66.3	21.1	8.4	4.2
3.05 - 3.17	67.0	24.2	4.4	4.4
3.17 - 3.40	54.9	30.1	5.3	9.7
3.40 - 3.54	60.9	28.7	8.0	2.4
3.54 - 3.76	49.4	34.9	5.5	11.1
3.76 - 3.94	32.3	52.9	2.9	11.9
3.94 - 4.36	35.8	38.9	23.2	2.1
4.36 - 4.52	36.0	37.0	6.0	21.0
4.52 - 4.75	39.0	42.0	7.0	12.0
4.75 - 5.08	19.8	57.1	14.3	8.8
5.08 - 5.59	28.0	38.0	20.0	14.0
5.59 - 6.10	10.1	57.3	25.8	7.8
6.10 - 7.14	22.2	36.8	21.3	19.7

TABLE VII

STRAIN P 16

Sample	% Diploid	% Triploid	% Tetraploid	% Indefinite
General	46.0	42.0	11.0	1.0
Under 6.10 mm	37.1	36.1	15.4	11.4
Over 6.10	31.1	36.5	16.2	16.2
3.17 - 3.40	55.0	20.0	0.0	25.0
3.40 - 3.54	53.3	28.9	7.8	10.0
3.54 - 3.76	51.3	30.0	10.0	8.7
3.76 - 3.94	58.5	21.9	12.2	7.4
3.94 - 4.36	43.4	33.3	14.1	9.2
4.36 - 4.52	40.0	43.0	8.0	9.0
4.52 - 4.75	40.2	34.5	2.3	23.0
4.75 - 5.08	31.0	41.0	16.0	12.0
5.08 - 5.59	41.0	33.3	14.1	11.6
5.59 - 6.10	16.0	43.0	32.0	9.0
6.10 - 7.14	22.7	39.2	23.7	14.4
7.14 - 7.53	22.0	54.0	16.0	8.0
7.53 - 8.33	18.0	40.0	28.0	14.0
8.33 °	19.4	43.5	19.4	17.7

TABLE VIII

Strain P 17

Sample	% Diploid	% Triploid	% Tetraploid	% Indefinite
General	20.2	32.5	20.2	27.1
Under 6.10 mm	42.9	21.4	8.3	27.4
Over 6.10	14.9	41.4	14.9	28.8
2.80 - 3.05	74.5	3.6	0.0	21.9
3.05 - 3.54	74.6	11.9	0.0	13.5
3.54 - 3.76	57.6	8.7	3.3	30.4
3.76 - 3.94	60.5	16.5	1.9	21.1
3.94 - 4.36	32.1	35.9	3.8	28.2
4.36 - 4.52	41.2	34.0	11.3	13.5
4.52 - 4.75	44.0	26.2	15.5	14.3
4.75 - 5.08	33.0	32.0	7.0	28.0
5.08 - 5.59	36.1	30.6	5.6	27.7
5.59 - 6.10	14.1	44.9	24.3	16.7
6.10 - 7.14	12.5	36.5	17.3	33.7
7.14 - 7.53	12.0	43.5	18.5	26.0
7.53 - 8.33	9.5	51.4	18.9	20.2
8.33 •	10.7	44.0	16.7	27.6

CEREAL CHEMISTRY DEPARTMENT

In the twelve months under review 13 reports were issued. These cover a wide range of investigations and, while most of the results are of an interim nature, progress on the whole has been satisfactory. The projects include work on spring and winter wheat variety trials and the influence of fertiliser practice and disease control methods on milling and baking quality.

The effect of nitrogen and potassium on the baking quality of Atle wheat:

These trials were laid down to study the effect of potassium and nitrogen at different levels and to determine the influence of potassium on nitrogen response. Muriate of potash was drilled at two levels: 1½ cwt and 3 cwt per acre. The nitrogenous fertiliser used was calcium ammonium nitrate which was applied at 1, 2, and 4 cwt per acre. The application of potassium appeared to influence the distribution of nitrogen between bran and endosperm. The increase in protein content obtained by increasing application of nitrogen was normal for the whole grain but comparatively lower for the endosperm. Baking quality at all treatment levels was similar with a slight preference for the samples receiving potassium without a nitrogen supplement. The other quality characteristics showed little variation with treatment.

Maximum Nitrogen Trials

Fertiliser treatments were the same as in previous years. Sulphate of ammonia (21 percent N) was applied at the rate of 0, 2, 4, 6, 8 and 10 cwt per acre. The results confirmed previous findings that deterioration in baking quality occurs when the quantity of nitrogen fertiliser exceeds 2 cwt per acre. One feature of particular interest was the increase in diastatic and alpha-amylase activity and the corresponding decrease in flour viscosity which occurred with increasing treatment.

Department of Agriculture - Cereal Breeding Station

The number of samples tested was considerably higher than last year's, and it is felt that this service can be of considerable help to the Department of Agriculture in the wheat breeding programme.

Department of Agriculture - Variety and Fertiliser Trials

Six varieties: Atle, Safir, Sel. 76, Sel. 124, Carpo and Ring were grown at three different nitrogen levels and at three different sites. The results (in press) show that the quality of Atle and Sel. 76 was better than that of the other varieties tested. The alpha-amylase activity of Carpo was high at all centres and other quality characteristics were also poor. The protein characteristics of Ring were good but alpha-amylase activity was generally higher than that of Atle or Sel. 76 and was very high at one centre.

The maximum nitrogen dressing was 2.5 cwt ammonium sulphate per acre and the results confirm that at this level the effect on quality is small.

Wheat Variety Trial

This trial was undertaken to check the results obtained on several established varieties in 1956 - 1957, which were then considered unsuitable for cultivation in this country. The results confirm the previous finding that Peko, Koga and Kam cannot be grown satisfactorily under Irish climatic conditions and that the baking quality of Atle is superior to that of Progress.

Winter Wheat Variety Trials

Five varieties were grown: Milfast, Dominator, Starke, Vega and Cappelle. Starke ripened very late and the quality of the small quantity of wheat harvested was very poor. Dominator was easily the best of the other varieties examined, and the possibility of extending the area under this variety should be considered.

Samples from the trials carried out by the Plant Pathology Department in the investigation of the effects of cultural practices on the incidence of take-all and eyespot were examined for quality differences. This investigation is continuing and it is not possible at this stage to make any useful comment on the results obtained.

Finally a report was prepared for the Minister for Agriculture on the milling and baking quality of the 1960 Irish wheat crop. The purpose of this investigation was to determine the maximum quantity of Irish wheat which could be included in millers' grists consistent with the production of palatable bread of reasonable quality. Tests for milling quality, diastatic activity, starch and protein quality and baking behaviour were carried out. The results obtained were compared with the data now available on the 1956, 1957 and 1959 wheat crops and a recommendation that the percentage of native wheat could be safely increased from 25 to 60 was issued.

P. Spillane, H. McGovern,
K. McGrath

NEMATOLOGY DEPARTMENT

The research of this department is concerned with the study of the bionomics and control of plant parasitic nematodes. Host-parasite relationships, population studies and resistance are the main features of this programme. In addition to research the department also provides a routine service in connection with seed certification, quarantine and specialist advisory work.

During the year the work of the department was extended to include investigations on virus yellows of sugar beet and its aphid vectors. This work was mainly concerned with studies on sources of virus yellows, aphid population trends on sugar beet, and control of the disease by spraying.

POTATO ROOT EELWORM *(Heterodera rostochiensis)*

(a) **Resistance**:

The resistant clonal material used in last year's tests was propagated. Further screening tests, in which 22 potato root eelworm populations were used, were also carried out. The results of these tests are given overleaf. The 22 populations used in these tests were drawn from counties Carlow, Cork, Galway, Kildare, Kilkenny, Limerick, Louth, Meath, Roscommon, Tipperary and Wexford. As shown overleaf a population collected at Heath, Athy, Co. Kildare, was found to form cysts varying in number from 2 to more than 100 on clones, some of which remained completely cyst-free when screened against the other populations. It is apparent from the results that this Athy population is aggressive. This is the first record of the occurrence of an aggressive potato root eelworm population in this country and it is proposed to screen *ex-solanum* multidissectum material against it in the coming season.

CLONE	RESISTANCE	REMARKS
Snowflake x C.P.C. 1690 x Ulster Knight		Seventeen cysts formed on the roots of one plant by the aggressive population. Remained cyst-free in 18 populations. Not tested against three of the populations.
C.P.C 1673 x Ulster Knight		Over 100 cysts formed on the roots of one plant by the aggressive population. Remained cyst-free in 10 populations. Not tested against 11 populations.
C.P.C 1685 x Gladstone		Sixty eight cysts formed on the roots of one plant and 38 cysts on the roots of another by the aggressive population. Remained cyst-free in 10 populations. Not tested against 11 populations.
C.P.C 1673 x Kerr's Pink x Craig's Defiance	H I	More than 100 cysts formed by the aggressive population on each of two plants. Remained cyst-free in 12 of the populations. Four cysts formed on one plant by a County Cork population. Not tested against eight populations.
C.P.C 1673 x Kerr's Pink x Craig's Defiance x Pentland Ace	H I (XI)	Two plants screened against the aggressive population failed. Remained cyst-free in 14 of the populations. One cyst formed on 1 plant by a Co. Tipperary population. Not tested against 6 populations
C.P.C 1673 x Kerr's Pink x 1565 (4) *	H I (XI)	More than 100 cysts formed by the aggressive population on each of two plants. Remained cyst-free in 12 of the populations. Three cysts formed on one plant by a County Cork population. Not tested against eight populations.
C.P.C. 1673 x Kerr's Pink x Craig's Defiance		More than 100 cysts formed by the aggressive population on the roots of one plant. Remained cyst-free against 20 of the populations. Not tested against 1 population.
C.P.C 1673 x Australian S. tuberosum x 1565 (4)*	HI(X)	More than 100 cysts formed by the aggressive population on one plant. Remained cyst-free in 18 of the populations. Not tested against three populations.
C.P.C 1673 x Kerr's Pink x Craig's Defiance x Pentland Ace	HI	37, 72, 8, 42, cysts formed by the aggressive population on the roots of four plants. Remained cyst-free against 21 populations.

CLONE	RESISTANCE	REMARKS
C.P.C 1673 x Kerr's Pink x 1565 (4)*	HI	More than 100, 33 and 21 cysts formed on the roots of three plants by the aggressive population. Remained cyst free against 21 populations.
Hybrid between colchicine - induced tetraploid clone of S. vernei and breeding clone of S. tuberosum. Descended from C.P.C stock of S. vernei (subsp. balsii).	H1	Not tested against 19 populations including the aggressive one. Seven cysts formed on the roots of one plant by a County Tipperary population. Remained cyst-free against two populations.
Hybrid between colchicine induced tetraploid clone of S. vernei and breeding clone of S. tuberosum. Descended from C.P.C. stock of S. vernei (subsp. balsii).	HI	Not tested against 19 populations including the aggressive one. The other three populations formed cysts varying in number from 1 to 6 on the roots of plants grown from this hybrid
Hybrid between colchicine - induced tetraploid clone of S. vernei and breeding clone of S. tuberosum. Descended from E.B.S. stock (subsp. verneii)	HI	The aggressive population formed four cysts and 1 cyst on the roots of two plants. Remained cyst-free against three populations. Not tested against 15 populations. The remaining three populations formed cysts varying in number from 1 to 13 in the roots of some plants.
Tetraploid S. vernei (by colchicine treatment)	HI	Screened against 22 populations. No cysts formed.

NOTE:

*	-	Blight resistant seedling
C.P.C	-	Commonwealth Potato Collection
E.B.S	-	Erwin Baur Collection of the Max Planck Institute, Cologne
H	-	Gene for resistance to potato root eelworm derived from subsp. andigena C.P.C. 1673
I	-	Wart immune
X	-	Hypersensitive (top necrotic) to virus X
(XI)		Immune from virus X - a characteristic originally present in C.P.C. 1673

b) A total of 2,400 samples was examined for potato root eelworm in connection with seed certification, quarantine and advisory work.

J. J. Duggan.

CEREAL ROOT EELWORM *(H.avenae)*

Observations on host-parasite relationships and population studies were continued on a field and microplot scale and data obtained regarding critical levels of infestation for oats, wheat and barley have been published. Further studies on the behaviour of *H. avenae* populations under different grass species are being initiated.

Over 600 plant and soil samples were examined for cereal root eelworm in connection with experimental and specialist advisory work.

Four varieties of oats, four of wheat and thirteen of barley were screened against two cereal root eelworm populations. The bulk of the material screened was supplied by the Cereal Station, Ballinacurra, Co. Cork. It is obvious from the results that some of the barley material merits re-testing because of the low cyst population formed on the roots of the plants during the test. It was also observed that one of the populations was aggressive and that it succeeded in forming many cysts on the roots of varieties which remained cyst-free in the other soil.

Each of the two soils used in these tests consisted of lots which had grown oats, wheat, barley and grass species the previous season and the tests were so designed that the oat, wheat and barley varieties tested were sown in each lot of soil. Four species of economically important grasses were also sown. The tests were carried out in this manner with a view to investigating the possible existence and development of strains of cereal root eelworm, specific to the crops mentioned above. The preliminary results were not conclusive and it is proposed to continue with the tests in the coming season. **J. J. Duggan**

BEET EELWORM *(Heterodera Schachtii)*

(a) Survey

Since beet eelworm is not widespread in this country it is important that new foci of infestation be detected as early as possible to prevent the pest from spreading and attaining disease-level proportions. During the year over 8,000 soil samples were examined in the laboratory and many host crops, including

sugar beet, were inspected during the growing season. Areas already known to be infested were intensively sampled and in cases where recommended rotations were practised it was observed that levels of infestations had decreased considerably. Two further outbreaks were recorded during the year and these occurred in a kitchen garden and in an adjoining vegetable garden in the Thurles area. While under the present arrangements for the encouragement and enforcement of crop rotation there have been no losses in yield from eelworm attack, the new outbreaks referred to above underline the importance of constantly keeping the position under review.

(b) Resistance

Work was continued on screening material for resistance to beet eelworm using a population which was initially drawn from different areas. Forty-two lines of sugar beet and fourteen *Beta* spp. were screened and complete resistance was found in the following:

Beta patellaris	(W 19C)
Beta patellaris	(W 40B)
Beta procumbens	(W 29A)
Beta webbiana	(W 30B)

An average of one cyst per plant was produced on one strain of *Beta maritima*, and these plants are being used for further tests.

(c) Re-appraisal of host range and preliminary studies on the host status of certain weeds and cultivated plants

Method:

Plants under test were grown in glass tubes which had been filled with sterilised soil and inoculated with ten beet eelworm cysts per tube. Tests were carried out in a greenhouse and the tubes were sown and bedded in trays of peat moss on 1/9/61. Results are shown in Table I *(overleaf)*.

TABLE I

AVERAGE WHITE CYST COUNT PER PLANT

PLANT	7/11/61	28/11/61	18/12/61	15/1/62
Broad-leaved dock	7	7.8	1	0.8
Love-lies-bleeding	0	0	0	0
Buckwheat	0	0	0	0
Sweet William	2	3.6	3.4	0.6
Gyposophilia	0	0	0	0
Cabbage	59.8	52.6	57	33.2
Garden Pea	0	0	0	0
Nasturtium	0	0	0	0
Groundsel	0	0	0	0
Spinach	2.6	2.4	0	0
Mangel	30.6	42.3	27.3	5
White Clover	0	0	0	0
Wild Carrot	0	0	0	0
Antirrhinum	0	0	0	0
Fat-Hen	0	0	0	0
Horse Radish	10.2	3	3.4	0.8
Sugar Beet	30.8	47	37.4	18.0
White Mustard	12.2	9.4	1.4	0.2
Rape	87.2	68.0	33	18.6
Black Bindweed	0	0	0	0
Marigold	0	0	0	0
Redshank and Knot-grass failed to grow				

(d) **Population Studies:**

Studies on population trends under different cropping sequences are in progress. These preliminary microplot studies are concerned with population increases under sugar beet, mangels, fodder beet, swedes and rape.

(e) **Other Work:**

Studies are also in progress on aspects of the life-cycle of beet eelworm, larval longevity, parthenogensis and morphology.

M. O'Reilly, F. McGloughlin

OTHER *HETERODERA SPP.*

Studies were continued on a **Heterodera** spp. found infecting the roots of common dock (*Rumex crispus*), and the following data were obtained:

The cysts were typically lemon-shaped; the average length (excluding the neck) of brown cysts taken from dock roots was 839.8 microns, the range being 536.8 to 1173 microns; the average width was 512.1 microns with a range of 402.6 to 634.4 microns and the average length to breadth ratio was 1.64 to 1.

Young females on bursting through the roots are of a pearly white colour. They later assume a bright yellow colour and mature cysts are brown. The yellow colour referred to does not reside in the cyst wall but flows out of the ruptured cyst with the body contents leaving behind the translucent cuticle.

A sub-crystalline layer is discernible in young white females. It persists in yellow cysts taking the form of an irregular patchy crust and it has been observed in mature brown cysts as faint waxy flakes adhering to minute portions of the cyst wall.

Egg-sacs varying in size from about one quarter to almost as large as the cyst itself were observed. In some of them, eggs were numerous and they were generally situated around the vulva in a central cylindrical mass. Vulval structures were studied in detail and will be described in a later publication.

Males of this species resemble those of *H. schachtii* and the tips of the spicula are bifid. However, in this species the anterior ends of the spicula are rounded and knob-like while in *H. schachtii* they appear to be truncate.

Host range and hatching tests coupled with the morphological studies briefly referred to above indicate that this species does not conform to any presently described *Heterodera*.. The name *H. rumicis* is tentatively suggested as a suitable specific name for this species.

J.J. Duggan

TUBER ROT EELWORM *(Ditylenchus destructor)*

The survey on the occurrence of this eelworm was continued and some 1,150 tuber samples were examined. There was a marked decrease in the incidence of tuber infection probably as a result of the control measures enforced following the previous year's survey.

Studies were continued on the morphology, host-range and pathology of this eelworm. Host-range tests involving a wide variety of cultivated plants and weed species were carried out and the following plants have been recorded as hosts for the first time: daisy *(Bellis perennis);* broad-leaved dock *(Rumex obtusifolius);* sow-thistle (*Sonchus asper)* and coltsfoot *(Tussilago farfara).* Red clover was found to be infected both in experimental pots and in fields which were under observation and in one instance infected plants were found almost two years following the harvesting of the infected potato crop. Carrot was also found to be susceptible to attack by this eelworm, the disease occurring mainly on the crown of the plant and extending for a short distance on the tap-root. The diseased portion of the root assumed a dry honey-combed appearance somewhat similar to that occurring on infected potato tubers and all stages of *D. destructor* were found in the discoloured tissue just below the cracked surface. It is conceivable from these observations that carrots could suffer severe damage on a field scale if sown in heavily infested soil.

Four lines of potato material bred from *Solanum tuberosum* subspp. *andigena* were also tested and were found to be susceptible to *D. destructor* attack.

Experiments on the development and spread of the disease in storage have been carried out and it was found that the disease can develop in infected tubers and spread to adjacent clean tubers during storage.

A varietal susceptibility test was carried out with 15 potato varieties which were planted in both infested and inoculated soil. Analysis of the mean indices of infestation showed that all varieties tested were equally susceptible to attack.

J.F. Moore

STEM EELWORM *(Ditylenchus dipsaci)*

Stem eelworm has been found on clover plants collected in different parts of the country. These plants have been planted in microplots and the host-preferences, morphological characters and the economic importance of the eelworm in question are being studied.

An experiment has also been laid down on the control of stem eelworm in phlox. Various time-temperature treatments have been used and the material treated has been planted out.

J.J.Duggan

LEAF AND BUD EELWORM *(Aphelenchoides spp.)*

Strawberry runners received in connection with the scheme for the propagation of eelworm-free strawberries were subjected to warm water treatment. Following treatment the pots containing the plants were bedded in peat moss in a glasshouse to give the plants an opportunity of recovering. They were later forwarded to growers in County Mayo.

As part of this scheme also, parent strawberry plants were examined for the presence of parasitic eelworms.

J.F. Moore

OTHER NEMATODE INVESTIGATIONS

Studies were continued on a species of root-knot eelworm *(Meloidogyne spp.)* found infecting lettuce plants under glass in late autumn and early winter. This species (referred to in the 1959 - 60 Report) which was found parasitising sugar beet in a soil that was being subjected to a growth-test for *Heterodera schachtii*, has now been found in six counties, but there is no indication of damage to the beet crop on a field scale.

investigations on this species of *Meloidogyne* are continuing.

Samples of mushroom compost and casing soil were examined during the year and the infesting eelworms in all cases were free living species, mostly *Rhabditis*.

J.J. Duggan, J.F.Moore

APHIDS AND VIRUS YELLOWS

1. Examination of sources

(i) Mangel clamps:

Mangel and fodder beet clamps in the main beet growing areas were examined for the presence of overwintering aphids at the end of March, April and May. A total of 200 clamps was examined, 19% of which were infested with aphids. Species identified are given in Table II.

TABLE II

SPECIES	NO. OF TIMES RECORDED
Myzus persicae (Sulz)	6
Myzus ascalonicus (Donc.)	3
Aulocorthum solani (Kalt.)	2
Macrosiphum solanifolii (Ashm.)	-
Aulocorthum circumflexum (Buckt.)	3
Rhopalosiphoninus staphyleae (Koch.)	29
Rhopalosiphoninus latysiphon (Davidson)	2
Aphis fabae (Scop.)	1

Live aphids were transferred to indicator plants in the greenhouse for 24 hours, after which the plants were grown on and examined for symptoms of virus yellows. On two occasions only, virus yellows was transmitted by aphids from mangel sprouts. The number of aphids in the clamps increased from March onwards.

(ii) Weeds:

Weed samples from near mangel clamps and from fields in which the preceding year's beet crops were grown were examined for aphids during the spring. Aphids were transferred to indicator plants, mild virus yellows being transmitted on three occasions from sowthistle,

groundsel and plantain by *Myzus ascalonicus* (Donc.).

(iii) Other sources:

Other overwintering sources of virus yellows and the aphids concerned in its transmission were examined during spring and early summer. These included potato tubers in storage, spindle and peach trees, glasshouses, *brassica* seed crops, sticklings, allotments and gardens.

2. Study on aphid trends on sugar beet in connection with spray warning

The soil sampling officers of An Foras Taluntais and selected beet loading agents from each factory area were given lectures and demonstrations regarding aphids and virus yellows. Each loading agent's area was divided into five sections and commencing when the beet crop emerged, four crops were examined once a week from each of these sections. Thus, a daily report was available for a section of each loading agent's area. Information regarding the number of aphids found was sent to the laboratory each day and in addition to this a sample of seedlings from each crop prior to singling, was also forwarded for examination in the laboratory. Over 4,000 of these samples were examined. Information regarding the occurrence of aphids and bulletins on aphid trends were sent to the senior agricultural adviser, in each of the sugar factories, who issued spray warnings to growers when aphid numbers reached the predetermined figure.

Black aphids appeared on almost all crops during 1961, infestation developing in many cases when the seedlings emerged and often reaching epidemic proportions. This pest was particularly troublesome in the Carlow area in June - July. Colonies were attacked on a large scale by ladybirds and also by *syrphids* and *hymenopterous* parasites while *entomophagous* fungi were noticed attacking them in the laboratory.

Green aphids appeared on sugar beet a little later than the black ones and were of less importance numerically. Samples of green aphids collected from sugar beet were identified as shown in Table III *(overleaf)*.

TABLE III

SPECIES	GREEN APHIDS COLLECTED %
Myzus persicae (Sulz.)	23.0
Aulocorthum solani (Kalt)	32.2
Macrosiphum solanifolii (Ashm.)	25.2
Rhopalosiphoninus staphyleae (Koch.)	3.7
Myzus ascalonicus (Donc.)	4.8
Others	11.1

3. Incidence of virus yellows in sugar beet crops

Results of virus yellows counts made on crops throughout the year are shown in Table IV.

TABLE IV

AREA	END OF JULY		END OF AUGUST		END OF SEPTEMBER	
	No. of fields examined	% V.Y	No. of fields examined	% V.Y	No. of fields examined	% V.Y
Thurles	156	1.12	151	2.87	111	5.27
Carlow	96	1.39	118	2.94	46	2.99
Tuam	131	0.44	128	1.29	124	3.74
Mallow	86	1.14	76	2.62	28	2.67
Av. %		1.02		2.43		3.67

4. Incidence of virus yellows in mangels and fodder beet crops

A number of counts was also made on mangel and fodder beet crops in October - November. Results are shown in Table V.

TABLE V

Area	No. of crops sampled	% V.Y
Thurles	133	8.77
Carlow	81	3.56
Tuam	119	2.29
Mallow	75	6.07
Average	-	5.17

Control of Virus yellows by Insecticides

Spraying trials with demeton methyl (i)

At three centres a Latin square trial was laid down, using demeton-methyl (i) at the recommended rate per acre. Counts

made on these throughout the season showed that spraying decreased the number of black and green aphids on the crop but the percentage virus yellows present at all centres was too low to assess the results of spraying.

Aphicide comparison trials

At three centres aphicide comparison trials were laid down using commercial aphicides at the recommended rate per acre. Aphicides used were: demeton-methyl (i); phorate (granules); dimethoate; fluoroacetamide; menazon; thiometon; and malathion.

Half of each plot in the randomised block arrangement was sprayed three weeks after the first spray. All sprays decreased aphid infestation, malathion being less persistent than the others. Virus yellows percentage was low at all centres but spraying decreased infection, two sprays being slightly more effective than one.

Aphicide screening in the laboratory

The above aphicides were screened in the laboratory using soil applications to aphid-infested pot ted beet plants. Malathion did not give complete kill, and menazon granules were slow acting giving a complete kill only after four days. Fluoroacetamide and menazon at 12 percent W/V gave 100 percent kill after 48 to 72 hours, the others in 24 - 48 hours. Phorate and demeton-methyl (i) were the quickest acting, killing 80 - 85 percent of the aphids after four hours.

R. Dunne

The work of this department may be grouped under four main headings as follows:-

(1) Effect of cultural practices
(2) Cultivation of new or unusual crops
(3) Screening tests on agricultural chemicals
(4) Weed control investigations

Effect of cultural practices on the yield and/or quality of crops

This work was done in close co-operation with Messrs. Guinness' and the Irish Sugar Company.

Time of sowing of malting barley

Malting barley, variety Proctor, was sown at five different dates during the spring. It was found that late sowing increased the nitrogen content to a level above that suitable for malting. The effect on yield and on thousand corn weight was slight, as shown by Table I.

TABLE I

Date of Sowing	Mean Yield cwt/acre	% Nitrogen in grain	Weight of 1,000 grains g
23.3.61	33.7	1.42	37.1
29.3.61	35.5	1.44	40.2
6.4.61	30.3	1.52	40.6
17.4.61	35.3	1.55	40.6
24.4.61	36.9	1.58	40.7
1.5.61	29.8	1.65	40.8

M. Neenan, M.C. Frost

Time of killing off potato haulms

This experiment was intended to simulate an early attack of blight *(Phytophthora infestans)*. Tops of six different varieties at each of two centres were burned off by means of a patent herbicide. Harvesting of all plots took place at the normal time. The results showed that some varieties increased by as much as one ton per acre per week at certain periods of the year. The yields of tubers are shown in Table II *(overleaf)*. The size distribution of the tubers in the last three killing off dates is given in Table III *(overleaf)*.

TABLE II

(Yield in tons per acre)

Variety	Centre	Date of killing off				
		24.7	1.8	9.8	17.8	25.8
Kerr's Pink	Creagh	6.0	7.4	11.3	11.0	13.3
King Edward	"	3.9	6.3	8.9	9.3	10.1
Arran Peak	"	4.4	6.2	12.3	10.6	10.7
Alpha	Oakpark	1.7	3.3	5.3	7.0	8.4
Record	"	3.2	4.1	6.6	9.9	11.3
Kennebec	"	4.4	5.1	7.4	10.6	13.1
Dekama	"	3.2	4.1	6.7	7.7	9.1
Dekama	Creagh	4.4	8.6	12.0	10.3	16.4
Ambassadeur	Oakpark	3.1	4.0	6.2	8.9	11.1
Ambassadeur	Creagh	5.2	7.7	12.7	11.1	14.8
Arran Banner	"	8.0	10.8	12.3	15.1	13.1
Arran Banner	Oakpark	3.3	4.3	6.1	9.4	11.7

TABLE III

Variety	Date of killing	% greater than 2¼"	1¼" - 2¼"	% less than 1¼"
Arran Banner	9.8	37.6	53.2	9.2
	17.8	51.1	45.1	3.8
	25.8	55.3	40.2	4.5
Alpha	9.8	16.1	68.3	15.6
	17.8	30.3	61.1	8.6
	25.8	42.0	52.8	5.2
Ambassadeur	9.8	7.6	70.2	23.2
	17.8	14.2	70.8	15.0
	25.8	14.8	72.8	12.4
Dekama	9.8	37.4	56.3	6.3
	17.8	46.2	45.0	8.8
	25.8	45.6	47.2	7.1
Record	9.8	16.7	74.2	9.1
	17.8	21.3	69.6	9.1
	25.8	34.8	60.0	5.2
Kennebec	9.8	52.3	32.5	15.2
	17.8	69.0	27.7	3.3
	25.8	82.4	14.5	3.1

M. Neenan, M.C. Frost

TABLE IV

Variety	Soil type	Yield (tons/acre)	Sp. Gravity	% D.M. Oven	% Starch	Colour [1]	Flavour [1]	Texture [1]
Kerr's Pink	Mineral	10.27	1.075	20.1	14.0	2.65	2.7	2.3
	Peat	8.00	1.072	18.8	11.9	2.90	2.7	2.6
Golden Wonder	Mineral	7.17	1.087	22.0	13.4	2.75	2.8	2.5
	Peat	5.30	1.088	20.0	14.3	2.50	3.3	3.1
Arran Banner	Mineral	13.43	1.061	16.4	10.8	2.45	2.0	1.3
	Peat	12.15	1.060	16.2	9.9	2.90	2.3	2.6
Arran Victory	Mineral	9.58	1.076	20.0	15.8	2.40	2.1	1.9
	Peat	7.21	1.075	19.7	13.0	2.40	2.2	2.4
Ulster Torch	Mineral	14.91	1.076	20.6	15.3	1.65	2.1	2.0
	Peat	13.18	1.076	19.7	11.9	2.20	2.2	2.4

[1] Maximum score - 5

TABLE V

CENTRE	VARIETY								
	Kennebec	Kerr's Pink	King Edward	Arran Banner	Arran Victory	Arran Peak	Record	Ambassadeur	Dakaara
Oakpark	11.84	-	8.12	11.00	8.25	8.69	10.82	9.59	11.42
Belclare	11.5	6.57	4.18	11.78	9.57	7.85	8.65	11.0	9.95
Moyne	-	13.5	8.0	12.5	11.0	11.5	15.0	16.5	16.5
Ballinasloe	-	15.5	10.0	14.0	15.5	15.5	14.5	14.0	16.0

Potato variety and soil type interaction at Lullymore

Five varieties were grown in randomised fashion on two adjoining areas, one of which was a peaty soil and the other a mineral soil. Samples were evaluated for flavour and other qualities at the Irish Sugar Company Food Processing Research Laboratory, Carlow. The results are shown in Table IV.

M. Neenan, J. Mulqueen

Variety and soil type interaction on different types of mineral soil

This trial was carried out in co-operation with the Irish Sugar Company, the object being to study the behaviour of different potato varieties on different soils. Three trials were carried out in County Galway and one at Oakpark, Carlow.

Complete data are not yet available; yields in tons per acre are shown in Table V.

M. Neenan

Comparison of seed potatoes of different origin

F.W. Went in the U.S.A has shown that the temperature at which "seed" potatoes are grown affects the subsequent yield for two generations. As a practical application of this finding it was decided to see if any differences occurred between potatoes of the same variety, but grown in different "climates" within this country. The yield of tubers in tons per acre are shown in Table VI.

TABLE VI

ORIGIN OF SEED	YIELD OF TUBERS
	tons per acre
Donegal A	14.0
Donegal B	14.7
Cork	14.8
Kerry	15.0
Wexford	13.1

The differences in yield were not statistically significant.

M. Neenan

Effect of combine drilling on the yield and incidence of weeds in fibre flax

This was a continuation of an experiment carried out in 1960. Germination capacity of the seed was poor and the crop received a check from the late spring frost. As a result yields were lower than those obtained in the previous year. Yields are shown in Table VII *(overleaf)*.

M. Neenan

TABLE VII

Fertiliser cwt per acre			Method of application	Yield of dried retted straw tons/acre	Yield of fibre stones/acre
Superphosphate	Muriate of potash	Sulphate of ammonia			
0	0	0	-	2.07	49.3
3	0	0	Broadcast	2.04	50.7
1½	0	0	Drilled	2.44	56.9
3	2	0	Broadcast	2.14	48.1
3	2	1	"	2.13	52.7
1½	1	0	Drilled	2.71	63.2
0	1½	0	"	2.35	66.3
1½	1	½	"	2.68	69.1

TABLE VIII

HEMP VARIETY TRIAL

Variety	% Fibre in dried retted straw	Yield of long fibre cwt/ac	Yield of tow cwt/ac	Total fibre cwt/acre
Fibrimon 21	20.5	11.9	2.8	14.7
Fibrimon 24	21.1	14.7	2.5	17.2
Fibrimon 56	19.9	13.2	2.4	15.6

Cultivation of new or unusual crops

Hemp Variety Trial

Three monoecious varieties from France were each sown in a randomised block experiment. Some of the crop was water retted and the remainder will be dew retted later in the year. Results to date which refer to water retted material are as shown in Table VIII.

M. Neenan

Variety and time of sowing of flax for oil production

Two varieties, Weira and Hyklema, were sown at two different dates. Severe shedding was caused by the gales in September. Yields of seed are shown in Table IX.

TABLE IX

VARIETY	TIME OF SOWING	YIELD OF SEED cwt/acre	OIL %
Weira	Early May	13.08	36.1
Weira	Second week in May	6.69	37.5
Hyklema	Early May	12:22	33.9
Hyklema	Second week in May	10.16	36.8

M. Neenan

Screening tests on agricultural chemicals

Screening tests on agricultural chemicals were begun. Three trials were carried out, one on seed dressings, one on weedkillers of the MCPA type and one on potato sprays. The first two were conducted at Oakpark and the latter at two centres in the northern counties, as well as at Oakpark. The materials tested were as follows:-

Seed dressings Abavit, Agrosan G., Ceresan, Ceresan W., Dieldrix A, Dielmer, Gammagran, Granadin, Golden Grain, Harversan, Mergamma, Seedox B, Mistomatic (liquid), Panogen-Astex (liquid).

Weedkillers Agritox, Agroxone K, Akodrin, Blitzweed super, Phenoxylene plus, Cornox M, Masterspray, Mortone, MCPA 25 (Hygiea), Raphone, Shell M. 25, Macipa.

Potato sprays Albert Copper, Blitox, Coppesan, Copper Sandoz, Duter, Trimangol, Perenox, Shell Copper, Soltosan, Tritoftorol, Dithane. All were compared to Burgundy mixture.

M. Neenan, T.M. Thomas, M.C. Frost

Catch-crop trial

This was sown on August 23 after an early cereal. Harvesting took place on February 1 and 2. Results are shown in Table X.

TABLE X

SPECIES	YIELD (tons/acre)
Swede turnips	7.69
Broadleaved rape	13.30
Westerwolds ryegrass	0.061
H.L. Ryegrass	0.135
Serradella ornithopius sativus	nil
Stubble turnip variety Novitas	9.94
Stubble turnip var. Mommersteigs halflarge	12.21
Stubble turnip var. Cevisto	14.11

M. Neenan

Maize for fodder The following varieties were grown as single plots:-

Wisconsin 273, Wisconsin 255, Wisconsin 240, Wisconsin 352, Caldera, Pioneer, and C.I.V.7

All were making satisfactory growth until destroyed by the gale on September 17.

M. Neenan

Oil crops for human consumption

An observation trial was carried out on mustard and poppies. Both grew satisfactorily and yielded 12.9 and 9.9 cwt seed per acre respectively. Further analysis is in progress.

M. Neenan

Weed control investigations

Cultivations versus weedkiller trial on potatoes

The view has been expressed that apart from weed control many of the cultivations carried out on potato crops are unnecessary.

Table XI shows the effects of cultivations on the yield of tubers.

TABLE XI

TREATMENT	YIELD OF TUBERS (tons per acre)
Poorly tilled ground no after-cultivations	7.2
Poorly tilled ground drills moulded once	8.7
Poorly tilled ground drills moulded twice	10.4
Poorly tilled ground pre-emergent weedkiller (DNBP)	7.9
Well tilled ground no after-cultivations	8.3
Well tilled ground drills moulded once	12.9
Well tilled ground drills moulded twice	12.9
Well tilled ground pre-emergent weedkiller	12.1

M. Neenan

Weed Control in Potatoes

Investigations on the chemical control of weeds in maincrop potatoes were carried out on crops grown on mineral and organic type soils.

Treatments

1 = DNBP amine salt @ 4 lb per acre
2 = DNBP + dalapon (4 lb + 5 lb per acre)
3 = diuron + CIPC (0.25 lb + 1 lb per acre)
4 = diquat (plus wetter) @ 1½ lb per acre
5 = diquat + dalapon (1½ lb + 5 lb per acre)
6 = propazine @ 2 lb per acre
7 = prometryne @ 2 lb per acre
8 = mechanical removal of weeds
9 = hand removal of weeds
10 = control (untreated)

Treatments 3, 6 and 7 were applied within three days after planting the potatoes. Treatments 1, 2, 3 and 5 were applied just before emergence of the crop. All the plots with the exception of treatment 8 were undisturbed throughout the season. Ordinary post-planting cultivations were carried out on plot 8.

Couch grass (*Agropyron repens*) was very prevalent at one trial centre. The principal broad leaved weeds present were fat hen, redshank, shepherd's purse and groundsel. Weed control data are shown in Table XII.

TABLE XII

TREATMENT	Percentage reduction of weeds compared with control plot					
	CENTRE A			CENTRE B		
	Red Shank	Shepherd's Purse	Fat Hen	Couch grass	Redshank	Groundsel
1	95	90	97	-	86	70
2	90	91	97	80	89	75
3	15	5	10	-	15	10
4	86	75	81	10	76	78
5	88	72	84	92	80	77
6	50	42	26	-	20	15
7	33	10	15	-	26	16
8	86	91	73	94	94	87

Yields were recorded at both trial centres. The highest yield at centre A was obtained from Treatment 8. At centre B the highest yield was obtained from treatment 1.

T.M. Thomas

Weed Control in Sugar Beet

Replicated field experiments were carried out at seven centres using the following treatments:-

Treatments

1 = 0.37 lb diuron + 0.18 lb CIPC per acre
2 = 0.50 lb diuron + 0.25 lb CIPC per acre
3 = 0.75 lb diuron + 0.37 lb CIPC per acre
4 = 0.62 lb OMU + 0.43 lb BIPC per acre
5 = 0.80 lb OMU + 0.57 lb BIPC per acre
6 = 2.28 lb endothal + 1.72 lb IPC per acre
7 = 3.42 lb endothal + 2.58 lb IPC per acre
8 = 4.56 lb endothal + 3.44 lb IPC per acre
9 = Control (untreated)

The chemicals were applied in 80 gallons of water per acre on the same day as the beet was sown. Liquid formulations were used in all cases.

Degree of weed control obtained was not consistent and varied from excellent to poor. Weed control varied with soil type and weather conditions, especially with the latter. In trials laid down during the dry weather in early May, weed control was poor in contrast to results obtained from trials carried out in April under conditions of lower temperature and higher moisture.

Damage to sugar beet plants occurred at some centres with the higher doses of all three chemicals. The main damage was stunting of the young plants and could be correlated with soil type and rainfall.

Yields were recorded at a number of centres (Table XIII).

TABLE XIII

Treatment	Yield of Roots in tons/acre			Sugar %		
	Centre A	Centre B	Centre E	Centre A	Centre B	Centre E
1	15.64	14.07	9.64	16.81	17.07	16.5
2	17.14	14.28	10.32	16.97	17.61	16.37
3	15.42	13.60	10.14	16.91	17.46	16.52
4	16.00	14.03	9.71	17.08	17.48	16.26
5	15.78	13.60	10.64	16.82	17.35	16.17
6	15.92	12.32	10.10	16.86	17.56	16.85
7	15.17	13.57	9.50	17.02	17.37	16.01
8	14.78	13.35	10.71	16.76	17.32	16.72
9	17.03	13.32	10.39	17.18	17.46	16.45

Powder and granular formulations of diuron/CIPC and diuron/IPC mixtures were applied to one site at Carlow. Because of the prevailing weather and soil conditions resulting in uneven germination of the beet crop, this trial yielded little information. There was however indications that the granular formulations seemed to give a better control of weeds than the liquid formulations under the prevailing high temperatures late in the sowing season.

While treatments 1, 2, 4, 6 and 7 show excellent promise for the control of the majority of common weeds with a high degree of safety to the crop, nevertheless, from evidence obtained, satisfactory results seem to be dependent on a number of factors, the chief of which are:-

(I) Soil type
(II) Soil moisture and temperature
(III) Rainfall after application
(IV) Prevailing air temperatures

T.M. Thomas

Control of Redshank *(Polygonum persicaria)* in Cereals

Following preliminary glasshouse trials, replicated field trials were laid down at two centres. Each herbicide was applied at a single dosage rate, the dosage in all cases being that which gave satisfactory results in preceding small scale trials

Treatments

1 = 2, 4-DP (amine salt) @ 2.5 lb acid equivalent per acre
2 = 2, 4-DB (sodium salt) @ 2.0 lb acid equivalent per acr
3 = CMPP (potassium salt) 1½ lb + MCPA (potassium salt) 1 lb per acre
4 = CMPP (potassium salt) 1½ lb + 2, 4-D (amine salt) 0.75 lb per acre
5 = Control (untreated)

All the herbicides were applied in 20 gals. water per acre to spring sown wheat *(Atle)* when the crop plants had five to six true leaves.

The dominant weed species at both trial sites was Redshank. Chickweed *(Stellaria media)* was also prevalent and degree of control obtained of both these species was assessed. Weeds at time of treatment varied from the seedling stage to four inches in height. No damage to the cereal crop at any stage of growth was observed.

Stage of growth of the redshank plants was an important factor with regard to the degree of control obtained. Stunting or partial kill of plants in the more advanced stages of growth was common, especially in the 2, 4-DB treated plots. Some redshank plants in the 2, 4-DP plots had green apical shoots but the stem was greatly reduced. Such plants were of no practical significance. Results are shown in Table XIV *(overleaf)*.

TABLE XIV

Treatment	% reduction of weeds compared with control plot			
	Centre A		Centre B	
	Redshank	Chickweed	Redshank	Chickweed
1	94	98	90	85
2	71	17	82	3
3	85	95	53	98
4	68	90	70	95

T.M. Thomas

Weed Control in Peas

The following treatments were carried out on the pea variety Big Ben.

Treatments

1 = Dinoseb (amine salt) @ 4 lb acid equivalent per acre
2 = 0.62 lb OMU + .43 lb BIPC per acre
3 = 0.25 lb Diuron + 1 lb CIPC per acre
4 = Dinoseb (amine salt) @ 2 lb acid equivalent per acre
5 = MCPB (sodium salt) @ 2 lb acid equivalent per acre
6 = Hoeing once
7 = Control (untreated)

All the herbicides were applied in 80 gallons water per acre. Treatments 1, 2, and 3 were applied on the same day as the peas were sown. Treatments 4 and 5 were applied when the peas were five to six inches high.

Yields from the treated plots were in all cases higher than those from the control plots except at centre B where the yield from treatment 5 was lower, but not significantly so.

No damage to the crop was observed in any of the treated plots except treatment 4 which caused about 15 percent leaf scorch and some slight scorch of stem. Weed control data are shown in Tables XV and XVI. *(overleat)*.

TABLE XV

CENTRE A Treatment	% reduction of weeds compared with control				
	Chickweed	Redshank	Fat hen	Perennial Sow Thistle	Creeping Thistle
1	100	100	92	2	-
2	97	82	84	-	-
3	92	86	80	-	-
4	97	66	96	-	-
5	-	48	87	60	84
6	47	66	70	62	58

TABLE XVI

CENTRE B Treatment	% reduction of weeds compared with control			
	Chickweed	Redshank	Fat hen	Perennial Sow Thistle
1	91	74	70	-
2	76	60	67	-
3	72	64	61	-
4	94	67	96	-
5	3	56	90	53
6	70	82	62	64

T.M. Thomas

Control of Corn Marigold in Cereals

Field experiments were laid down in Co. Wexford where a high population of corn marigold *(Chrysanthemum segetum)* was present. The following treatments were applied:-

Treatments

1 = DNBP amine salt @ 1.5 lb a.e per acre
2 = DNBP ammonium salt @ 1.0 lb a.e. per acre
3 = DNOC (activated) @ 6 lb per acre
4 = DNBP amine salt @ 1.5 lb + MCPA .31 lb per acre
5 = DNBP ammonium salt 0.8 lb + MCPA .31 lb per acre
6 = Control (untreated)

The trials were carried out in spring sown barley. All treatments were applied in 80 gallons water per acre when the crop plants had

four to five true leaves. Corn marigold plants varied from the seedling stage of growth to three inches in height.

Some scorch of cereal was obtained from all the treatments. The crop in all cases fully recovered later.

Weather conditions at the time of application of the herbicides were not favourable for best results and further experiments are necessary before definite comparisons can be made. Results are shown in Table XVII.

TABLE XVII

Treatment	% reduction of Corn Marigold compared with control plot	
	Centre A	Centre B
1	82	80
2	85	88
3	84	73
4	83	78
5	87	85

T.M. Thomas

Desiccation of Sugar Beet Seed Crops

The trial was carried out on diploid and tetraploid sugar beet crops. The desiccant used was diquat at 1, 1½, 2 lb per acre, applied at different stages of maturity of the seed crop. The object was to determine the optimum time of application.

Best results were obtained by applying 1½ lb diquat near the stage of maturity at which the crop would be normally cut and subsequently stooked in the field. The seed plants treated thus were successfully cut and threshed four days after treatment. Germination of seed was not impaired by any treatment.

Chemical desiccation shows excellent promise of making possible the harvesting of sugar beet seed with a combine harvester.

T.M. Thomas

PLANT PATHOLOGY DEPARTMENT

The work of this department is concerned with investigating diseases of cereals, root crops, soft fruit and vegetables.

EFFECT OF EYESPOT, *CERCOSPORELLA HERPOTRICHOIDES*, ON QUALITY OF MALTING BARLEY

A small scale experiment was laid down on a ploughed-up old pasture to find the effect of the eyespot fungus on quality of malting barley. The technique of infection used was that designed by Macer at Cambridge whereby autoclaved nodal straws in glass jars were infected with a liquid (2 per cent glucose broth) culture of *Cerosporella herpotrichoides*. The colonised straws were inserted in the soil along the rows of seedlings of the plots to be infected. The infection was carried out at different stages of seedling growth and control plots were also kept for comparison.

Yield and 1,000 corn weight were reduced in the more severely diseased plots and infection also reduced the nitrogen content of the grain but not significantly. The investigation will be repeated in 1962.

P.C. Cunningham

EFFECT OF METHOD AND RATE OF SEEDING ON THE INCIDENCE OF SOIL BORNE DISEASES AND ON YIELD OF MALTING BARLEY

The site of the trial had carried five successive cereals. The experimental layout was a randomised block of twelve treatments with fourfold replication. The seeding treatments consisted of three rates and two methods of seeding, and each seeding treatment did or did not receive a nitrogenous top dressing (2½ cwt calcium ammonium nitrate/acre at braird).

A disease diagnosis was carried out at the braird stage. The percentage of shoots with eyespot was low and no definite trend was apparent as a result of reduced seeding. A disease index was prepared for take-all and the percentage infected plants showed an increase with reduced seeding. Records were also made of the numbers of roots (main roots) *lesioned* with take-all without ref-

erence to the amount of disease on the individual root: the numbers of diseased roots per plant were found to reduce with increased seeding and thus confirmed the trend from the disease index. On calculating the total amount of diseased roots per sample this figure increased with increased seeding and illustrates the numbers of infected roots per unit volume of soil.

A pre-harvest diagnosis was also carried out and results are shown in Table I.

TABLE I

DISEASE LEVELS AT PRE-HARVEST DIAGNOSIS AND YIELD

N APPLICATION	NON TOPDRESSED						TOPDRESSED					
Method of Seeding	Broadcast			Drilled			Broadcast			Drilled		
Rate of seeding (st./acre)	5	8	11	5	8	11	5	8	11	5	8	11
% Eyespot	46.4	50.8	55.6	44.0	48.1	54.9	49.8	43.3	60.2	56.2	60.9	50.1
% Sharp Eyespot	1.5	3.1	1.0	5.9	2.9	1.9	4.7	4.4	1.8	3.6	1.8	1.6
% Take-all from disease index	35.1	43.8	44.7	46.5	34.7	33.2	27.8	40.6	37.3	32.3	24.4	26.3
Yield (cwt/acre at 20% moisture)	19.7	17.7	18.9	15.9	17.0	17.7	33.2	31.4	36.6	27.3	34.9	35.8

The percentage straws with eyespot appeared to increase with increased seeding, particularly in the non-topdressed treatments. The nitrogenous topdressing had no consistent effect on the level of eyespot. Sharp eyespot was not very prevalent.

There was no apparent influence of seeding rate on percentage of straws with roots diseased by take-all, though nitrogen had a considerable effect on the level of this disease. All seeding treatments which were topdressed had a lower disease index than their non-topdressed counterparts.

The most spectacular feature of the yield results was the very appreciable increases due to nitrogenous topdressing. There was little difference in yield between the two methods of sowing whilst there was a slight trend towards increased yield with increased seeding rate.

P.C. Cunningham

THE INFLUENCE OF TIME OF PLOUGHING AND DATE OF SOWING ON THE INCIDENCE OF *OPHIOBOLUS GRAMINIS* AND *CERCOSPORELLA HERPOTRICHOIDES* IN SPRING WHEAT

This field experiment was laid down on a site that had been intensively cropped with cereals. Ploughing was done in November, February and early April. Sowing was carried out at three weekly intervals in mid-March, early April and late April. A disease assessment was done at the braird stage and a second diagnosis was carried out at the pre-ripening stage.

Early ploughing reduced the level of take-all infection while late sowing had an even more pronounced effect. The percentage take-all infection of late April sown plots was less than half that of those sown in mid-March. The interval between ploughing and sowing was also important and when ploughing immediately preceded sowing take-all infection was greatest.

Early sowing also increased the percentage of straws with severe eyespot whilst the percentage of straws severely *lesioned* from the late April sowing was negligible. Nitrogenous topdressing at time of sowing reduced take-all and increased total eyespot though it did not generally increase the percentage of straws with severe eyespot.

P.C. Cunningham

MISCELLANEOUS STUDIES OF TAKE-ALL ROOT ROT

Host studies in the field showed that scutch, *Agropyron repens*, was the most extensive non-cereal host. In addition to root infection, rhizomes were often severely infected and numerous isolates of *Ophiobolus graminis* were obtained from these. It was observed that take-all patches in cereal crops were most abundant and severe where scutch was present. The root system of Yorkshire fog, *Holcus lanatus*, was also severely infected by *Ophiobolus graminis* but other *graminiae* including *Agrostis spp.* from the same infected field were free from infection. An examination of more than twenty species of annual weeds also gave negative results.

Pathogenicity studies were made of an isolate of *Ophiobolus graminis var. avenae* and an isolate of *Ophiobolus graminis* on

wheat, oats, barley and rye. The work was done in sterilised and non sterilised soils. The infection level was three times greater in the sterilised than in the non-sterilised medium. The infection rating from the oat strain of take-all was lower than that from *Ophiobolus graminis* except with oats. Oats showed high resistance to *Ophiobolus graminis*. In sterilised and non-sterilised soils rye was more resistant than wheat and barley to both isolates and more resistant than oats to the oat isolate.

P.C. Cunningham

SEED TRANSMISSION OF *PERONOSPORA SCHACHTII* FUCKEL

Sugar beet seed harvested in 1960 from plants known to have been infected in the steckling beds and exposed to downy mildew infection during the seed production season was obtained for this work. The seed finally selected for the transmission trial came from: (1) mildewed shoots; (2) apparently healthy shoots on diseased plants; and (3) healthy plants grown in close proximity to diseased ones. Seed produced in a greenhouse was used as a control. The seeds were sown at the end of February in a greenhouse situated in a non-beet growing area. Observations were made at frequent intervals during the growing period for symptoms or fructifications of downy mildew. As no diseased plants had appeared after eleven weeks growth the trial was discontinued.

C. Comerford

THE PERFECT STAGE OF *PHOMA BETAE*

The perfect or perithecial stage of *Phoma betae* was first recorded by Bjorling in 1944 as *Pleospora betae*, and in recent years it has been reported in England and New Zealand. In spring, mangel and sugar beet stems obtained from the main seed producing areas were examined microscopically for perithecia and ascospores. This examination showed, quite unexpectedly, that perithecia with numerous ascospores were produced in abundance while pycnidia and pycnospores were difficult to find. Only a few perithecia had previously been found in this country while pycnidia are usually seen in large numbers on old seed stems.

The ascospores were readily discharged from moistened peri- [illegible] on to agar plates and single spore isolates on potato dextrose agar were identical with those obtained from a pycnospore of *Phoma betae*. These observations confirm Bjorling's findings in Sweden that ascospores from fragments of stubble are available in abundance throughout the growing season and constitute a source of infection to growing crops.

C. Comerford

CHEMICAL SOIL DRESSINGS FOR CONTROL OF CLUB ROOT

During 1960 it was established that calomel and PCNB preparations, applied directly to the soil prior to transplanting, afforded good control of club root. On the other hand, application of aldrin dust gave poor control of the disease. All three chemical treatments, however, caused a significant increase in yield of marketable heads over untreated controls.

The effectiveness of these three chemicals at three rates of application was investigated during 1961 in a field experiment laid down on land that was heavily contaminated with *Plasmodiophora brassicae* Woron. The nine fungicidal treatments and the untreated controls were replicated five times on plots of 48 Greyhound cabbage plants.

The plants were harvested when mature and the number and weight of marketable heads were recorded. The roots were then dug up and carefully graded according to the extent of clubbing. The best control of the disease was given by PCNB at the lowest rate. This treatment gave a disease index reading significantly better than (i) the untreated, (ii) calomel at the lowest rate, (iii) PCNB at the intermediate rate and (iv) all three aldrin treatments. Three further treatments, the two highest applications of calomel and the largest dose of PCNB gave significantly better disease control than the untreated.

The control of the disease given by PCNB at the lowest rate was reflected in increased yields of marketable heads which were significantly better than those from the aldrin treatments and the untreated plots.

C. Comerford

CONTROL OF CLUB ROOT OF CABBAGE

This experiment was undertaken to investigate the effectiveness of various chemical treatments applied at the time of transplanting for the control of club root of cabbage on land heavily contaminated with *P. brassicae*. All the chemicals that were tested in the corresponding experiment in 1960 (Technical Progress Report 1959 - 60) were included in this experiment and also dieldrin. There were 19 chemical treatments in all. Each treatment was replicated four times on plots of 40 Greyhound cabbage plants.

Harvesting was carried out when the plants were mature and the roots were graded for club root infection. The results showed that the 4 percent calomel paste treatment gave the best control of the disease, significantly better than the control and seven other treatments. This treatment, however, did not give a corresponding increase in yield of marketable heads. Aldrin applied at ½ pint of an 0.75 percent solution per dibble hole was the only other treatment to give a significantly lower disease index reading than the control.

Zineb and captan treatments gave the highest yields of marketable heads, significantly higher than a number of treatments even though they did not significantly reduce the amount of club root.

C. Comerford

SEED DRESSINGS FOR THE CONTROL OF CLUB ROOT OF SWEDES

A greenhouse experiment was undertaken to test and compare the effectiveness of various chemicals affixed to the seed with a sticker for the control of club root of swedes. Thirteen chemical seed dressings, an untreated control and a mercuric chloride soil dressing were used in the experiment. The latter treatment was included for comparison purposes.

Artificially inoculated soil in water-tight containers was used for this experiment. The soil in the containers was inoculated by adding the volume of spore suspension required to provide 1,000,000

spores per g air-dried soil. The moisture content of the soil was maintained at 70 percent of its maximum water holding capacity by weighing the containers at least twice a week and replacing the water lost.

The plants were carefully lifted after 8 weeks' growth in the contaminated soil. The roots were graded for club root infection and a disease index calculated. The results showed that six treatments, calomel, captan, a dieldrin-thiram preparation, thiram, zineb and ziram gave disease index readings considerably lower than the untreated controls. The three former treatments reduced the development of the disease by more than 50 percent. The best control of the disease was given by the mercuric chloride soil dressing though it was only slightly better than calomel. The remaining treatments gave little or no control of the disease.

It appears from the results that some treatments may be useful in delaying and reducing infections. Field trials are required, however, under conditions leading to severe infection before any recommendations can be made.

C. Comerford

RESISTANCE TO CLUB ROOT IN VARIETIES OF SWEDES, TURNIPS, RAPES AND KALES

The purpose of this work was to investigate the relative resistance to *P. brassicae* of different varieties of swedes, turnips, rapes and kales commonly grown in Ireland and to ascertain if varieties bred for resistance in other countries are resistant under our conditions. Greenhouse experiments were used mainly for this work.

The varieties were grown in artificially contaminated soil in water-tight containers. The soil was inoculated and the moisture content maintained constant as described for the seed dressing experiment.

Swedes:

The reaction of 32 swede varieties to *P. brassicae* inoculum of two different origins was investigated. Sixteen of these varieties have been recorded as showing high resistance to *P. brassicae* in other countries while the reaction of the remaining varieties was investigated because of their high yields on soils free from *P. brassicae*.

The results showed that there is a wide range of resistance and susceptibility to *P. brassicae* within the swede varieties tested. A number of varieties appeared to be highly resistant to club root, notably Wye, Doon Spartan, Coxton Crofter, Weibull's 0503, Wilhelmsburger 57/137 and Wilhelmsburger Trifolium XI. The low disease indices of a number of other varieties such a Wilhelmsburger Otofte XI and F, Gro Vidarshov and Green Top indicate that they possess marked resistance.

Certain varieties gave high disease index readings and appear to be in the highly susceptible class. These are Acme, Champion Purple Top, Conqueror, Magnificent, Monarch, Parkside Bronze Top, Peerless, R.34. Tipperary and Townhead. Within these varieties there seems to be enough plants susceptible to infection to cause a big reduction in yield on club root infected soil.

The differential reaction of some of the swede varieties to the two sources of inoculum used in this investigation is indicative of the existence of two or more strains or races of *P. brassicae* within the country. This factor makes it necessary to exercise some caution in the application of these results to a different environment.

Turnips: This work was undertaken to compare the resistance of 24 varieties of turnips to *P. brassicae* spores from two widely separated localities. Twenty-three of these varieties are claimed to be resistant by research workers and seed producers while the remaining variety Aberdeen Green Top was included as a control.

Four varieties, Meetjeslander, Leislander, Mommersteig's 1379 and Novitas remained free from symptoms of the disease in this experiment. In another group of varieties consisting of Kvit Mai Forus, Civasto Knolvoet-resistant, Wasslander and Mommersteig's 1382, a small amount of the plants, less than 8 percent, was diseased. Three selections from Svalof's, Sweden and Maj Turnip also had low susceptibility indices and therefore they must be considered highly resistant.

On the other hand, Aberdeen Green Top, Dale's Hybrid, Yellow Tankard, The Bruce, The Wallace and Snowball each showed a high percentage of infected plants and appear to be susceptible.

Rapes: The relative resistance of five types of rape to *P. brassicae* was investigated in a greenhouse trial. The plants were lifted after nine weeks' growth in the infected soil. The roots were graded for club root infection and a disease index calculated. The results are presented in Table II.

TABLE II

READINGS OF DISEASE SEVERITY ON FIVE TYPES OF RAPE

TYPE	DISEASE INDEX (Scale 0-100)
Giant English	30
Broad Leaf Essex	25
Dwarf Essex	27
Svalof Matador	30
Club Root Resistant	2
S.E. (9 d.f)	1.3

The Club Root Resistant type displayed marked resistance but there was no significant difference between the remaining types.

Kales: The four common types of kale were exposed to *P. brassicae* inoculum in this greenhouse experiment. The plants were lifted after nine weeks' growth in the infected soil and the results were analysed by preparing a disease index, Table III.

TABLE III

READINGS OF DISEASE SEVERITY ON FOUR TYPES OF KALE

TYPE	DISEASE INDEX (Scale 0-100)
Marrow Stem	13
Thousand Head	18
Canson	26
Hungry Gap	10
S.E (9 d.f)	2.0

Variance analysis showed that variations between varieties are significant at the 5 percent level, due mainly to Canson being more susceptible than the others. The disease index of Hungry Gap suggests that it has some degree of resistance.

C. Comerford

WORK ON VIRUS FREE FRUIT

Strawberries: Virus free strawberries were received from East Malling Research Station on February 23. There were four different varieties: Huxley; Talisman; Cambridge Vigour; and Red Gauntlet. They were planted in sterilised soil bed in an insect-proof house.

Raspberries: Virus free raspberries were received from the Scottish Horticultural Research Station, Mylnefield on March 29. There were six different varieties: Malling Jewel; Malling Enterprise; Malling Promise; Norfolk Giant; Burnetholm Seedling and Lloyd George. These were planted in a similar manner to the strawberries. Both were sprayed at intervals with a systemic insecticide as well as the house being fumigated periodically against the introduction of insect vectors.

F. O'Riordain

FUNGI AS VIRUS VECTORS

An experiment was carried out to test the possibility of *Phytophthora infestans* (Mont.) de Bary acting as a virus vector. Potato leaflets infected with virus X were inoculated with the fungus. When the fungus was fructifying over the complete surface of the leaflet, conidial transfers were made to Campbell's V-8 juice agar. Agar and fungus were macerated and the resulting liquid used for sap inoculations on *Chenopodium amaranticolor* and *Datura stramonium*. These gave a negative result, but this does not rule out the possibility of *Phytophthora* acting as a virus vector, as there are many interacting factors in this problem.

F. O'Riordain

BLACK ROT OF CARROTS

Cylindrocarpon radicicola Wollenw. was isolated frequently from

carrots with a severe black rot. Infection studies were conducted but these did not give the high degree of infection obtained in the field (over 60 percent) so experiments are continuing to find the factor influencing infection.

F. O'Riordain

CUCUMBER WILT

Wilted cucumber plants from Kinsealy were examined and *Verticillium albo-atrum* Reinke and Berth. was isolated from the stems.

F. O'Riordain.

STEM ROT AND DIE BACK OF CARNATIONS

In November, carnations from Kinsealy were examined and *Fusarium culmorum* (W.G.Sm.) Sacc. isolated from them. These plants died as they were coming into flower. Not more than one percent of the plants was affected.

F. O'Riordain

SOIL MYCOLOGY

In April, a study was commenced on the soil microflora of a rotational field trial of wheat and barley in connection with the changes in the level of *Ophiobolus graminis* Sacc. infection in the soil

A study was made of techniques used in isolating soil fungi and Warcup's soil plate method was adopted. Preliminary experments were carried out to compare the relative merits of two isolating media, peptone dextrose agar with rose bengal and streptomycin, and potato dextrose agar with norobiocin. A number of fungi was isolated and identification studies were commenced on these. Among the commonest fungi were species of *Absidia, Mucor, Trichoderma, Fusarium, Cylindrocarpon, Penicillium and Gliocladium.*

A. Mangan.

WILT OF MANGELS

Attempts were made to isolate a possible fungal pathogen from roots of wilted mangels. Organisms were isolated from roots of diseased and healthy plants. A number of these was identified but no correlation was obtained between individual fungi and healthy plants or between individual fungi and diseased plants.

C. Comerford, A. Mangan.

PLANT CHEMISTRY AND BIOCHEMISTRY DEPARTMENT

This department was set up at Thurles towards the end of 1960. At first the work was concerned with the routine chemical analysis of sugar beet. In 1961, the headquarters of the department were transferred to Oakpark and new laboratories have been provided. The work of the department at Oakpark, in addition to its investigations on sugar beet at Thurles, will be concerned with fundamental research on the factors influencing quality in all crops. The necessary chemical analysis will be provided for the pesticide and herbicide testing service which the Institute proposes to establish. Facilities are also to be provided for the routine dry matter analysis of various crops produced at Oakpark.

CHEMICAL ANALYSIS OF SUGAR BEET

During the period under review the produce from 2846 varietal trial plots and 9,800 mother roots were analysed in full. The potassium and sodium contents of 818 beet samples from 11 manurial trial plots of the Thurles sugar factory area were determined. Several samples of swedes, fodder beet and sugar beet seed were analysed for dry matter content.

During the year some improvements in analytical procedures were effected. Certain instruments were fitted with special scales for the direct reading of analytical results. A new automatic balance for use in sugar beet analysis was devised and introduced. With this balance the proportional quantity of lead acetate solution is measured out for any quantity of brei between 13 and 30 g, and the two operations of weighing the brei and dispensing of lead acetate reagent are combined in one. It was found that this balance increased the analytical precision of sugar determinations threefold

Qualitative chromatographic analyses of beet extracts showed that Irish beet varieties have but trace quantities of raffinose. It was also observed that in March beet roots contained a greater number and quantity of amino acids, mono and oligo-saccharides than in December. Since these impurities are optically active the accuracy of sugar values by polarisation is reduced, e.g. roots, which in December gave 15 - 16 percent sugar, recorded 17 - 18

pastens in March. For more reliable sugar values it seems advisable to have samples of beet completed by December 31st.

In the light of developments elsewhere it is necessary to review the methods at present being used in sugar beet analysis, and schemes are being considered with the aim of introducing a scientific assessment of beet quality based on chemical analysis.

M. J. Clancy

Scientific Publications

"Storage of elite sugar beet seed" (B. Crombie, 25th Winter Congress of I.I.R.B. *(in press)*

"Special glasshouses for sugar beet breeding" (B. Crombie, Ibid)

"Polyploid sugar beet in Ireland" (B. Crombie and L. J. O' Connor, Ibid.

"Utilisation of ground rock phosphate by different species of plants" (M. Neenan, Irish Journal of Agricultural Research) *(in press)*

"Seasonal variations in the activity of cereal root eelworm" (J. J. Duggan, Sci. Proc. Royal Dublin Society, series B, No. 3. Vol. 1 (1961)

"The effect of cereal root eelworm (*Heterodera Major*, O. Schmidt) on its hosts" (J. J. Duggan, Irish Journal of Agricultural Research, Vol. 1. No. 1 (1961)

"Host range of rubbery-rot eelworm (*Ditylenchus destructor*)" (J. J. Duggan and J. F. Moore, Irish Journal of Agricultural Research) *(in press)*